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INSTRUCTIONS
FOR MOUNTING, USING, AND CARING FOR
DISAPPEARING CARRIAGES
L. F. MODEL OF 1894 MI
FOR
10-INCH GUNS
Models of 1888, 1888 MI, and 1888 MII

(*TEN PLATES*)

MAY 20, 1904
REVISED OCTOBER 18, 1913

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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U.S. Ordnance dept.

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L. C.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, D. C., October 18, 1913.

This manual is published for the information and government of the Regular Army and Organized Militia of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

365262

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INSTRUCTIONS FOR MOUNTING, USING, AND CARING FOR DISAPPEARING CARRIAGES, L. F., MODEL 1894 MI, FOR 10-INCH GUNS, MODELS 1888, 1888 MI AND MII.

(Thirteen plates.)

(The points in italics are of particular importance, or concern the safety of the carriage, and should be specially noted.)

GENERAL DESCRIPTION.

The Emplacement (Pl. I).—Emplacements for these carriages are entirely of concrete, permitting traversing through a field of fire of 140°. A semicircle of six steps leads from the loading platform down to the gun platform. Being for a front pintle carriage, this is on two levels. The base ring rests on the upper level around the counterweight well. Fifteen and a half inches lower is placed the rear traverse rail on the second level.

The anchor bolts are set in the concrete as the emplacement is constructed, the depressions for the thrust plates being also provided.

The Carriage (Pls. II, III, IV, and V).—The carriage is the front pintle type and mounts guns of the 1888, 1888 MI and MII models.

It embodies many additions and improvements on the original model, the principal ones of which are new tripping device having strong single pawls and allowing tripping from either side, elevation counterbalance device, wire rope retraction with motor, 3-inch telescopic sight and sighting platform, elevation disk and pointer with gearing, buffer valve, azimuth pointer, electrical contacts and conduits, safety firing switch and cables, and telephone bracket.

The rear traverse rail, in four sections, allows a field of fire of 140°. In some emplacements an extension rail is used and a field of fire of 170° obtained. Stops are provided to prevent running the carriage off the rail. The piece may be elevated from 5° depression to 12° elevation.

The elevating system is so constructed that the gun is at an angle of about 5° elevation when in the loading position if recoiling to the nineteenth notch with any angle of elevation in battery.

Action of Carriage.—Upon firing the piece the gun lever axle is moved to the rear by the recoiling energy of the gun, carrying the top carriage with it. The lower ends of the levers move vertically upward, being constrained by the crosshead traveling on the vertical crosshead guides. The trunnions of the gun move downward and to the rear in the arc of an ellipse. The energy of recoil is absorbed partly by raising the counterweight and partly by the movement of the masses up the inclined chassis rails, but principally by the resistance of the recoil cylinders, and when the gun comes to rest it has the proper loading angle. After loading the pawls are tripped, and the excess of the moment of the counterweight over the moment of the gun, etc., enables it to raise the gun to the firing position. If this excess be small, the velocity of counter recoil will be slow; but if more counterweight be added the velocity will increase and the time required for going into battery will decrease.

PRINCIPAL PARTS.—The carriage consists of the following principal parts, viz: Base ring, rear traverse rail, azimuth circle and pointer, traversing system, racer, clips and dust guards, chassis and transom, top carriage and recoil rollers, recoil and counter-recoil system, gun levers, crosshead, tripping gear, counterweight (lead), bottom plate and suspension rods, elevating arm, band, and slide, elevation disk and pointer, elevating system, counterbalance device, traversing system, retracting system, retracting gear, clutch, and brake, working platform, sighting standards and platforms, sight-laying mechanism, firing and lighting circuits, electric-motor equipment for retracting the gun, and the accessories, including ammunition trucks, shot tongs, and implements.

BASE RING (Pl. VI).—The base ring is made of cast iron in a single piece. It is held in position on the foundation by sixteen 2-inch bolts. Sixteen screws are provided for leveling the base ring. They screw through holes in the base ring near the foundation bolt holes and bear against steel thrust plates. The lower roller path is machined on the upper face of the base ring. The male part of the pintle surface is machined on the outer surface of an annular flange extending upward from near the middle part of the base ring. A sheet-steel dust guard, made in four sections, is attached to the racer and extends downward to overlap the base ring for protecting the traversing roller system from dirt and moisture. The annular flange forming the pintle surface has at its top a lip inward under which the racer clip engages. The cavity on the inner side of the roller path is drained into the pit by means of drain holes drilled through the pintle flange.

REAR TRAVERSE RAIL (Pl. II, III, and IV).—The rear traverse rail serves to support the traversing wheels which carry the weight of the rear part of the carriage. It is circular, 180° in length, and is made of cast iron, in four segments. Each segment is provided with seven 2-inch holes for holding down bolts, and with five tapped holes for leveling screws. The path for the traversing wheels is machined upon its upper surface. The azimuth circle is attached immediately in rear of this path.

AZIMUTH CIRCLE AND POINTER.—A brass azimuth circle is recessed into the horizontal surface on the rear traverse rail. It is graduated in degrees in the shop. The figures for numbering the degree marks are added after the carriage has been mounted in its emplacement. The azimuth pointer body is fastened to the traverse-wheel transom by two screws through slotted holes in the body, thus allowing a slight adjustment in azimuth. The body carries the azimuth subscale graduated to 0.05 of a degree and the micrometer head reading in hundredths of a degree. The micrometer head operates the index which moves across the subscale.

TRAVERSING SYSTEM (Pl. II, III, IV, and VI).—The system around the pintle consists of 20 forged-steel conical rollers, held in proper relative positions by inner and outer wrought-iron distance rings, each forged in one piece. The rollers are forged with a trunnion at each end. The rings are united by separator braces, the bearings are slotted down through and caps are screwed up under the trunnions of four rollers to hold the rings down in place, the whole being kept concentric with the pintle by flanges on the inner end of the rollers in centrifugal contact with the inner edge of roller paths. The system over the transverse rail consists of a transom supporting the rear end of chassis and carrying four pins upon which cast-steel wheels with conical rims revolve upon roller bearings.

RACER (Pl. VI).—The racer rests and is traversed upon a circle of live rollers and supports the front end of the chassis. It is made of cast steel, in a single piece. The upper roller path is machined on its under surface, and the female part of the pintle is machined on the inner surface of an annular flange extending downward. Its upper surface is provided with two faced-off pads whereon the chassis rests. A clip bolted down on a third pad surface engages under the pintle flange to prevent lifting. Four oil holes and a spiral groove are provided for oiling the pintle surface.

DUST GUARDS.—A dust guard in four sections is bolted to the outer edge of the racer; the lower edge of the dust guard bears through felt strips against a flange on the outer side of the base ring.

CHASSIS AND TRANSOMS (Pl. II, III, and IV).—The chassis are made of cast steel. Each is secured at its front end to the racer by seventeen 1½-inch tap bolts, and is secured at its rear end to the traverse-wheel transom by thirteen 1½-inch tap bolts. The chassis are united in rear of the crosshead guides by a cast-steel transom, by a second cast-steel transom in front of the elevating rack, and near their rear end by the traverse-wheel transom. Vertical crosshead guides are machined on the chassis near their front ends. The upper surface is inclined downward to the front at an angle of 2° from the horizontal to facilitate the return of the gun into battery. The chassis have U-shaped recesses to receive the recoil rollers in the top flanges, the outer edges of which are extended to enter the top carriage clips.

TOP CARRIAGE AND RECOIL ROLLERS (Pl. II and III).—The recoil rollers of forged steel support the weight of the top carriage and parts connected thereto, projecting above the chassis just sufficiently to prevent rubbing contact. There are nine recoil rollers in each chassis rail. They are bushed with bronze, and revolve upon axles whose ends are forced in the sides of the U-shaped recesses in the chassis.

The top carriage is made of cast iron. It consists of two side frames, with a uniting transom cast in a single piece. In the case of a few carriages in service an additional transom or stiffening rib has been added to strengthen the original pattern. Each side frame is bored out, forming a recoil cylinder, and carries a trunnion bed for the support of the gun-lever axle. In those cases where it was found necessary in order to prevent leakage the cylinders were provided with bronze liners three-fourths inch thick. Clips extending under the whole length of the cylinders engage under flanges on the outer edges of the chassis.

THE RECOIL AND COUNTER-RECOIL SYSTEM (Pl. X).—The plate shows the general arrangement of the hydraulic brake and its connections, in its essential principles, and in relative positions of parts for disappearing carriages "in battery." The cylinders have an 11-inch bore. In each cylinder there operates a piston rod 4 inches in diameter, carrying a piston head 10.98 inches in diameter. The piston rod projects through stuffing boxes at the front and rear ends of the cylinders, and is secured directly to the chassis at its front end and is supported at its rear end by a bracket attached to the chassis. In rear of the piston head forged-steel collars with a slight taper are shrunk around the rod and pinned in place. They form the male part of the counter-recoil buffers and fit into the female buffer on the rear cylinder head. This consists of a No. 4 bronze cylinder which is screwed and doweled to the rear cylinder head and fits snugly inside the recoil cylinder. At the end of counter recoil the oil imprisoned in this buffer can escape only through the small clearance provided between the male and female parts and through the outlet provided to the buffer valve, thus checking the velocity of the moving parts and bringing the top carriage to rest against the stops without appreciable shock.

Each cylinder has a filling hole with plug, near its front end. That portion of the cylinders above the level of the filling holes (about 150 cubic inches in each) is intended to be empty, thus providing room for the expansion of the oil when heated by the weather or by the work of retarding the recoil, and also providing spaces into which the male buffers may be withdrawn. This withdrawal is accomplished so rapidly in recoil that the flow of oil through the small clearance between the male and female buffers is not sufficient to prevent a high pressure due to this cause if the cylinders were full.

To secure equal resistance and fluid pressure in each cylinder their front ends are connected by an equalizing pipe, from which a connecting pipe extends rearward to the throttling valve, which is placed in a pipe connecting the rear ends of the cylinders. The connecting pipe also affords passage for oil from the buffer valve placed in a pipe connecting the buffer cavities.

Plugs are provided to close the cylinders, thus continuing the piece in action should the pipes be injured.

For emptying the cylinders valve plugs are provided in the equalizing pipe coupling.

When oil is being added, the filling plugs should be removed from both cylinders to permit the escape of air and thus insure the proper filling of both cylinders.

In recoil the top carriage is drawn over the pistons. Each piston is slotted through opposite sides, and throttling bars bolted to the cylinders partially close these orifices. The sectional areas are varied so that the areas of orifice for the flow of the oil vary with the position of the pistons during recoil in such a manner as to obtain a constant resistance with a variable velocity of retarded recoil of the top carriage.

As in any hydraulic brake the resistance is greater as the velocity of the recoil is greater and as the area of the orifices for the passage of the oil is less. The desired constant resistance is obtained by increasing the areas of orifice from the beginning of motion to the point of maximum velocity of the top carriage and then decreasing them to practically zero at the end of motion.

The areas of orifice must be calculated for a particular set of conditions, including mean temperature, and variations in these conditions may change the length of recoil of the top carriage, and consequently the height and inclination of the breech of the gun in the loading position. It has therefore been found desirable to provide a throttling valve for varying the resistance of the brake in order that variations in the prescribed length of recoil may be reduced to a minimum.

The reduction in the time of counter recoil, resulting in increased work of the counter-recoil buffers and the variations in the action of the oil, has led to the application, to all carriages, of a counter-recoil buffer valve.

The openings for the passage of oil from the front to the rear side of the pistons are as follows:

(*a*) The necessary working clearance between the cylinders and the pistons is 0.02 inch of diameter and is constant throughout the recoil.

(*b*) The orifices between the throttling bars and the slots in the pistons change with the varying profile of the bars, since the slots, partly closed by the bars, are of constant area.

(*c*) The opening of the throttling valve which controls the flow through the pipes between the front and rear ends of the cylinders is of constant area during recoil, but may be changed from round to round to secure the correct recoil under varying temperatures, loads, conditions of carriage, and openings of buffer valves.

(*d*) The buffer-valve opening, together with the throttling-valve opening, constitutes the aggregate by-pass through the piping.

Obviously any change in this opening necessitates a corresponding opposite change in the throttling-valve opening unless a change in the length of recoil is also desired.

The required settings of the throttling valve to give a nearly uniform length of recoil differ in the different carriages and in the same carriage may differ widely with the same load under different conditions. It is necessary, therefore, *that careful records be kept of all the conditions affecting the recoil for each shot and that these records be studied* to obtain the most uniform results possible. These records should include weight of projectile, muzzle velocity, temperature of air, setting of throttling valve and buffer valve, and length of recoil; also any abnormal conditions affecting recoil.

For all charges the cylinder should be filled to the level of the filling holes with the prescribed oil of a specific gravity of about 0.85 (such as "hydroline," now issued). With this oil the working pressure in the cylinders is about 700 pounds per square inch. A denser oil would cause a higher pressure and therefore shorten the recoil. About 40.5 gallons are required for filling the system.

For the purpose of reducing the shock of accidental excessive recoil, recoil buffers, made up of alternate layers of balata and steel plates, are placed on brackets bolted to the rear of the chassis, where they will be struck by the upper ends of the gun levers if the gun is retracted or recoils beyond its proper position.

Should the gun recoil to engage the pawls, but remain short of the loading angle, it may be retracted the remaining distance by hand or electric power.

The throttling valve can be adjusted to give openings varying by 0.013 square inch from 0 to 0.4 square inch. The graduations of the valve are stamped on the top of the body, there being 11 divisions, numbered 0.04, 0.08, etc. *One complete turn of the valve effects a* *change of 0.026 square inch in the opening. One-half turn effects a change of 0.013 square inch.* One complete turn of the valve yoke generally changes the length of recoil by the equivalent of three or four notches on the crosshead rack. This is liable to vary by a notch or more for different carriages or for the same carriage under different conditions.

The setting of the valve best suited to different conditions of loading, full or practice charges, etc., can be determined only by experience in actual firings with each particular carriage. Different carriages may require different settings, and the same carriage may even at different times require different settings for the same conditions of loading if it is in a materially different condition as to cleanness and lubrication of the working parts, etc. It is necessary, therefore, that careful records be kept, not only of the setting of the valve, the conditions of loading and recoil, but also of the elevation of the piece and any abnormal condition of the carriage which might affect the freedom of its operation. These records should be studied in the light of all these circumstances to obtain perfect working. However, the ammunition trucks are so designed that the loading position may vary somewhat without material inconvenience, and it is generally possible after a few firings with a carriage to determine the settings of the valve which will result in the gun coming into a proper loading position for any conditions of loading. *For full charges the valve should in the lack of experience with the particular carriage be opened to about 0.12 square inch,* including the opening of buffer valve.

BUFFER VALVE.—This valve consists essentially of a body, stem, disk, and latch which serves to lock the valve at any desired degree of opening. The valve is closed at 0 and when locked at the notch numbered 80 the opening is 0.1105 square inch, the change in opening from 0 to 0.1105 being uniform for each notch.

The buffer valve should be opened as few notches as possible and yet permit the top carriage with full counterweight to go into battery without a perceptible "stop and start" before striking the stops.

The top carriage should not strike the stop with sufficient force to rebound.

The required opening of both these valves decreases with the increase of temperature.

It will be noted that in counter recoil that the oil in the buffers escapes only through the buffer valve, the throttling pipes being closed by the piston head, while in recoil both valves allow the escape of oil, so that the aggregate opening must be always considered in recoil.

Padlocks are provided for locking the valves in any position to guard against accidents or unauthorized changes. This should not be understood to discourage examination and manipulation, which is on the contrary highly desirable for the sake of familiarizing the personnel with their construction and operation.

From a consideration of the principles of recoil and counter-recoil systems it is evident that a change in the length of recoil should be obtained by changing the setting of the throttling valve and not by changing the amount of counterweight. A change in the rapidity of the counter recoil should be obtained by changing the amount of counterweight used and by changing the setting of the buffer valve.

GUN LEVERS (Pls. II, III, and IV).—The gun levers of cast steel serve to support the counterweight at the lower end and the gun at the upper end, the whole being supported by the top carriage. The gun trunnions rest in bronze bushed trunnion beds at the upper end of the gun levers. The counterweight is supported through the suspension-rod shaft, which is carried in bronze bushed bearings at their lower ends. The weight of the gun levers, gun, and counterweight is supported by the gun-lever axle of forged steel, which rests in bronzed bushed axle beds in the top carriage. They are forced into position on the gun-lever axle and are keyed thereto.

CROSSHEAD.—The crosshead unites the levers and counterweights and provides bearing surfaces for constraining the latter to travel vertically. It consists of two crosshead clips of cast steel, which are screwed and pinned to the outer ends of the suspension-rod shaft of forged steel. The surfaces which bear against the crosshead guides are provided with Tobin bronze liners secured by countersunk screws. Teeth for engaging the crosshead pawls are cut on the front face of each crosshead clip.

TRIPPING GEAR (Pls. II and III).—The tripping gear is designed to hold the gun in the from-battery position for loading and to permit its return into battery when desired. The gun is held from battery by means of pawls secured to the chassis, which prevent the counterweight from descending by engaging in the teeth cut on the crosshead. After the gun is loaded it is permitted to rise to the firing position by raising the tripping levers until they are latched, and immediately leaving them in that position.

The action is entirely automatic after the pawls are latched out of engagement and the gun starts into battery. After the crosshead teeth have passed entirely below the pawl teeth and the gun is nearly in battery the pawl levers are released from the latches by the automatic action of the dogs on the crosshead, and are returned by the moment of the weight of the tripping levers, etc., to their proper positions ready to engage the crosshead when it again rises. The pawls may be tripped by the use of one or both levers. The notches between the ratchet teeth are numbered from the top. Brass strips with numbers from 1 to 22 are fastened to the sides of the chassis, and pointers on the crosshead slips indicate on these strips the notch at which the gun may be in recoil.

When the top pawl teeth engage in the nineteenth notch, the gun is in its calculated loading position, below which it should not be retracted. By a proper adjustment of the throttling valve the recoil of the gun should not vary much from this position. The ammunition truck will, however, permit the gun to be loaded at any permissible recoil.

COUNTERWEIGHT, BOTTOM PLATE, AND SUSPENSION RODS (Pl. VI).—The counterweight, 60 inches in diameter, consists of a number of circular lead plates, on top of which are two layers of semicircular weights. It comprises a cast-steel bottom plate 3 inches thick, stiffened with cross ribs; 11 lead plates 5.25 inches thick, weighing about 5,380 pounds; 2 semicircular flanged plates 3 inches thick, weighing about 1,250 pounds each; 2 semicircular plates 5 inches thick, weighing about 1,550 pounds each, and on some carriages between the twelfth and thirteenth layers above are 2 semicircular plates 3 inches thick, weighing about 1,500 pounds each. The counterweight is secured to the suspension-rod shaft by means of 2 suspension rods 4.5 inches in diameter, 7 feet 6 inches long, which pass through holes in the lead counterweights and bottom plate, and are provided with 2 nuts at their lower end. At their upper end they are bored out to receive the suspension-rod shaft. Care must be exercised that each suspension rod supports one-half the weight of the counterweight.

ELEVATING ARM BAND AND SLIDE (Pls. II, III, and IV).—The elevating arm serves to unite the elevating band on the gun to the elevating racks, which may be removed up or down to vary the elevation of the gun. It is made of two forged steel arms united by a cast-steel transom. Bronze bushed capped bearings for the elevating band trunnions are provided at its upper ends, and bronze bushed bearings for the elevating rack pins are provided at the lower ends.

The elevating racks slide in inclined guides bolted to the chassis, both being made of cast steel and the racks lined with bronze. They are formed with pins, engaging the lower bearings of the elevating arms, and with lugs, which come in contact with spring buffers to prevent shocks to the carriage when the gun reaches its limit of elevation with too great velocity. Stop pins are screwed in, to limit movement to zero degrees or 5° depression. The elevating system of gearing moves the racks, arm, and gun from 12° elevation to 5° depression when permitted by the construction of the emplacement.

In order that the gun might always return to exactly the same loading angle, the recoil being to the nineteenth notch, whatever might be the firing angle, it would be necessary to make the elevating racks circular, with a radius of path of pin equal to the length of the elevating arm. Expense of manufacture has made it undesirable to do this. They have been made straight, but so located that no objectionable variation in the loading angle is obtained.

ELEVATION DISK AND POINTER.—The elevation disk consists of a wheel carrying the graduated subcaliber and service range scales at its outer circumference. It is riveted to the disk gear, being operated, though an idler, by the driving gear which is located on the hub of the left elevating gear. Degree marks are stamped in the center of the scale for use in checking the disk by a clinometer. The scale is not equicrescent. The up-and-down motion of the elevating rack rotates the pinion and shaft and the circular wheel carrying the scales. A spiral spring takes up backlash in the gear teeth.

The degree marks are placed on the disk with the gun mounted upon the carriage and by the use of a clinometer supported by a rest placed in the muzzle. This is usually done at the time of the shop test.

As the ranges corresponding to different angles of elevation above the horizontal depend upon the height at which the gun is mounted above the sea level, the range scales must be graduated after mounting. The range graduations must be calculated for each gun with due regard to the height above sea level and the normal muzzle velocity. These graduations should then be marked upon the scale in the proper place *under the supervision of the Ordnance Department.*

The pointers provide flush zero marks for each scale and are arranged for adjustment in arc, which may be necessary for a particular field of fire if the emplacement settles unevenly. The pointer piece is bolted to a bracket bolted to the chassis. Adjustment requires the use of the clinometer as described above. The degree marks are placed at every 5° from 5° depression to 10° elevation. Ranges on the scale are graduated at every 20 yards and numbered on every hundred.

ELEVATING SYSTEM (Pls. II, III, and IV).—For use in elevating or depressing the gun a handwheel is provided on the left side of the carriage. This handwheel is fitted to the handwheel pinion, which turns upon a pivot held in the handwheel bracket attached to the left chassis. The handwheel pinion drives an intermediate gear fitted to the outer hub of the piston drum, which is on the left end of the intermediate shaft. On the intermediate shaft which passes through both chassis are two pinions, one on the outside of either chassis. These drive the elevating gears fitted to the outer ends of the elevating pinion shafts, which extend through each chassis. Upon the inner end of the elevating pinion shafts are the elevating pinions meshing with the elevating racks.

To relieve the gearing system of sudden strains incident to firing, a friction drum is provided. This consists of a clamp brake wherein the jaws are normally held closed by a spiral spring. The raising of the clamp lever carrying a double cam opens the jaws and releases the grip of the brake, permitting rotation of the handwheels. The brake should be adjusted by tightening the nuts at the end of the spring bolt just enough to permit the loaded gun to be depressed. Two spring buffers attached to a transom across the lower ends of the guides come in contact with lug on the elevating slide when at maximum elevation, thus relieving shocks to the carriage. The elevating slide may also be actuated by a slow-motion elevating handwheel adjacent to the elevation disk on the left side of the carriage through a train of gears. A clutch is provided for engaging or disengaging the slow-motion gearing at will.

Counterbalance Device.—This device tends to equalize the force required for elevating and for depressing the gun in the loading as well as in the firing position. It consists of a cast-iron weight hung by wire ropes, which pass over pulleys secured to the rear transom, and are attached through buffer springs to the elevating racks. It thus opposes and partially counterbalances the weight of the slide and one-half the weight of the elevating arm.

Traversing System (Pls. III and IV).—Traversing cranks are provided on each side of the carriage on the ends of a shaft supported by brackets on the traverse wheel transom. By means of two pairs of bevel gears the traversing pinion shaft is turned. This shaft is vertical, and the pinion on its lower end meshes in the rack on the rear traverse rail, thus moving the carriage in azimuth.

Retracting System.—For hauling the gun down by hand two removable crank handles may be attached to the retracting crank shaft and maneuvered by eight men standing on the working platform, four working on each crank. The retracting shaft actuates, through a train of bevel and spur gearing, two drums, to which are fastened by corrugated clamps two wire ropes, which wind upon the drum. A ratchet and pawl prevents the load from overhauling the gearing. From the drums these ropes pass around guide pulleys in rear of the recoil buffers and are hooked to the upper ends of the gun levers. These ropes remain with the carriage and when not in use are wound upon the drums until the ropes project but a short distance from the guide-pulley brackets.

For rapid and easy overhauling of the ropes a small handwheel is fixed to the crank shaft back of crank handles. To save time, these should also be used to wind up the slack of the rope before placing the crank handles on the shaft. In hauling down care should be exercised that each rope is under *equal tension.*

After taking up the slack in the ropes and putting some strain on them they should be vibrated slightly, and if found to be unequally loaded adjustment should be made at the rope clamps on the drums. After the loop of the rope is placed over the hook on the gun levers, and while winding up the slack, especial care should be taken that the rope is guided to the pulleys without any kinks or any slack and that the coils lie smoothly upon the drums without crossing the ridges between the grooves.

The wire ropes should always be detached from the gun-lever hooks before tripping.

On account of the extra counterweight used to decrease the time of going into battery, the operation of retraction requires the application of considerably more power than would otherwise be the case. Retraction by hand power will therefore be found somewhat difficult. This is, however, not expected to be objectionable, as retraction by the electric motor supplied is regarded as the normal practice, retraction by hand being provided for use principally in case of trouble with the electrical plant.

RETRACTING GEAR, CLUTCH, AND BRAKE.—To permit the most rapid overhauling of the wire ropes possible, there has been added a spring-engaging claw clutch for rotating the drum shaft from the drum gear in retracting. With the clutch thrown off, the ropes can be drawn out quickly, revolving the drums and shaft rapidly in the drum gear.

In order to prevent overrunning and injury to the ropes, a band brake is added, gripping the hub of the left drum upon lifting a crank handle. The clutch is thrown off by drawing a loop handle on the left side until the feathers are drawn out and permit the handle to be given a quarter turn. This locks the clutch off with the spring compressed.

When enough rope is overhauled the brake is raised to stop the shaft, the loop is given a quarter turn back to permit the feathers to enter, and the spring moves the clutch on its feathers in the drum shaft to engagement.

WORKING PLATFORM.—This is on two levels, the upper surface of the racer and the lower level on which rests the rear traverse rail. All operations except tripping may be performed by men on the lower level.

SIGHTING STANDARDS AND PLATFORMS (Pls. III and IV).—A platform of plates and angles extends along the left side of the carriage, supported in front and rear by standards bolted to the side of the chassis. These standards are of cast steel.

A flight of steps is provided at the front and rear end of the platform. Handrails and a screen to protect the gunner's body from the elevating arm during recoil of the piece are also provided. This platform furnishes not only a station for sighting, pointing, and firing (by electrical power) but also a convenient means of access to the gun, retracting hook, trunnion bed, etc., on the left side, for oiling or other purposes. On the right side of the carriage the old sighting platform has been retained for convenience. It consists of a small platform near the rear of the gun and is provided with a handrail and ladder for reaching the platform.

Sight Standard.—The standard forming the rear support of the sighting platform is called the sight standard, as the top of it forms the seat for the sight-arm bracket. This bracket fits over the head of the standard and extends to the front, affording a pivot and guide for the sight arm. It is bolted through a horizontal flange to a corresponding flange near the top of the standard. A lug on the bracket flange is finished between two set screws seated in lugs on the standard flange. By means of these screws slight rotation may be given the bracket, thus bringing the line of collimation of the telescope parallel to the axis of the bore.

To this standard are also attached the brackets for the shoulder rest and the firing pistol. The sight arm carries the combined bar sight and 3-inch telescopic sight, model of 1904.

The Firing Circuit (Pls. VII and IX) obtains its current from a dry-cell battery, one wire from which leads through the safety firing switch to the "ground" near the breech of the gun; the other through the firing pistol and safety firing switch to the primer. Both wires lead up the gun levers and along the gun and are incased in flexible metallic conduits for protection. *The gun should be fired only by closing the circuit at the firing pistol after the circuit has been closed for both wires at the safety firing switch.*

The firing pistol must not be placed in the circuit between the battery and the ground on the gun, as in this case it is possible to fire the gun before the safety firing switch is closed if a ground occurs between the battery and the firing pistol.

The pistol case incloses not only the contracts brought together by the trigger pull but also a buzzer, enabling the gunner to know that the block is completely closed and the connection complete for firing. Pressing the button over the trigger completes a circuit through a resistance coil and magnet coils of high resistance, these coils being shunted across the trigger contacts. The interrupter and magnet constitute a buzzer. The buzzer current, which is just strong enough to actuate the buzzer hammer but not strong enough to explode the primer, is kept on for an instant only. The ear should be held close to the buzzer to detect the sound. Pulling the trigger completes the circuit independently of the high resistance buzzer, and permits the passage of sufficient current to fire the piece.

The body of the safety firing switch, carrying two knife blades, is pivoted to a base attached to the chassis, the clips and their base being attached to the top carriage. When "in battery" the clips are directly above the blades and contact is made by raising the blades. The corrugation and bead of the slips and blades will retain them in contact until the top carriage moves to the rear. This motion separates them and causes the blades to drop. It is evident that contact can not be made until the top carriage is in battery, or nearly so, its return to within 2.5 inches of the stops permitting the switch to be closed.

In Lanyard Firing, from the loading platform, at attachment prevents the discharge of the piece before it has risen sufficiently for the shot to clear the parapet. This safety device is attached to the elevating band, and consists of an incased reel, upon which a short cable is automatically wound by a spiral spring, and which is locked (except when the piece is in battery) by a ratchet and pawl. One end of a short lanyard is hooked to the primer and the other to the end of this cable. The long lanyard in the hands of the cannoneer is also hooked to this cable. A pull on the lanyard when the gun is out of battery can not unwind the cable, pull the short lanyard, or fire the primer. When the gun rises into battery a cam on the elevating band passing under the pawl lifts it out of engagement with the reel, which can then be unwound, permitting the primer to be fired.

The initial tension of the spring should be sufficient only to wind up the cable with lanyards attached. To adjust, loosen the nut on the spring shaft and, using a wrench on the squared end of the shaft (projecting from the center of the case), withdraw the locking pin, and wind up or unwind the spring. Then return the locking pin to one of the quarter-turn positions and tighten the nut.

A device on the block, acting with the firing mechanism, model of 1903, also prevents possible firing of the primer by lanyard until the breechblock is within about one-half inch of being closed, measured on the circumference of the breechblock.

Conduits and Wiring (Pls. VII, VIII, and IX).—A 3-inch pipe installed by the Engineer Corps carries the telephone, lighting, and power leads to an ordnance terminal box located under the rear edge of the base ring. A removable iron cover is provided for easy access. From this box the leads pass up through the flange of the base ring and into a swivel connection bolted over the hole. The swivel has five outlets through which the leads pass into flexible metallic conduits, which wind on a drum. This drum turns on a hollow shaft supported by a bracket bolted to the right chassis. When the carriage is traversed away from the normal the conduits unwind, thus allowing a fixed contact for the leads at the upper terminal box. A spring around the drum shaft winds up the drum on the reverse movement. The leads, after passing through the flexible conduits, go to the center of the drum and thence up the hollow shaft to the upper terminal box at the center of the carriage. From here the leads go to their respective destinations. The wiring system as shown on the diagrams is as far as possible inclosed in a conduit system of wrought-iron pipes, fittings, junction boxes, etc., all with interior insulation and outlet insulators at the ends of the pipes. Twisted hooks and thimbles are supplied where necessary to carry wires which are not in conduits. The conductors for the firing circuits are completely inclosed in flexible metallic hose, entirely separate from other wiring.

LIGHTING CIRCUIT (Pls. VII, VIII, and IX).—This consists of three 16-candlepower lamps, one on each side of the carriage and one in the center between the chassis. They are controlled by one switch located on the rear standard. There are also provided two 8-candlepower lamps for illuminating the azimuth pointer and range disk pointer. These are controlled by the same switch located near the range pointer. Two 2-candlepower lamps are used for illuminating the deflection scale and cross wires of the sight and are controlled by the same switch as for the range and azimuth lights. An 8-candlepower lamp is located at the throttling valve and is controlled by a switch located near it. A portable light is provided by the Engineer Department for each carriage, with sufficient cable to reach any part of the carriage from the two plug boxes, one on each side of the carriage; all lamps are shaded so as to illuminate only the parts intended.

RETRACTING MOTOR.—For power retraction a 4-horsepower motor at 625 revolutions per minute, shunt wound with 100 per cent overload capacity, is supported by a bracket bolted to the racer. An idler gear may be thrown in mesh with the gear on the motor shaft and the gear on the drum shaft. A maneuver lever, guided and held in two positions by an arc bolted to the chassis, effects the engagement of the gears. With the maneuver lever thrown to the rear notch the motor is in gear for retracting, and to the forward notch the motor is thrown out of gear.

The clutch lever should never be left between notches and should never be moved while the motor is running. A clutch in the hand retracting gear system is also connected, through a system of rods and levers, to the maneuver lever. This is inserted so that when the motor is used the gears for the hand power will be disengaged from the drum shaft. Power is supplied through the engineer terminal box from the emplacement direct to the motor and starting rheostat. The current is usually at 110 volts pressure, but at some forts 220 volts is in use.

THE AUTOMATIC NO-VOLTAGE RELEASE STARTING RHEOSTAT (Pl. VII) is used to slowly start the motor by gradually cutting out resistance inserted in series with the motor armature, until when approximately full speed is reached the resistance is all cut out. All motors should be started in this manner, for if current is supplied to them directly from the source of power without intervening resistance before the motor has reached approximately full speed an unduly large current will flow, which will, if the motor is protected by fuzes or circuit breakers, burn out the fuzes or open the circuit breakers, and if the motor is not so protected will burn off the insulation of the armature windings.

In addition to the no-voltage release device there is mounted on the panel a double-pole, single-throw switch for connecting the starting rheostat to the line, and two fuzes of the inclosed type connected between the line wires and the switch.

The connections on the panel are so made that the motor field and the magnet of the no-voltage release are energized only when the double-pole switch is closed.

This instrument is mounted in a cast-iron, weatherproof box, carried by a bracket which is bolted to the rear of the left chassis.

Referring to the diagram, the line wires connected to the emplacement mains run directly from the upper terminal box to the starting rheostat, and are connected to the fuzes. One of the leads to the motor armature comes from a binding post connected to one pole of the switch and the other from a binding post located near the segments and connected with the starting handle.

Binding posts are provided for connection to leads for both ends of the field coil, though one side of the field may be connected directly to the proper brush of the motor.

In starting the motor the line switch is first closed and the motor is then gradually brought up to speed by moving the handle from the "off" to the running position.

The motor may be stopped by opening the line switch, and the switch should always remain open when the motor is not in use.

This rheostat consists of contacts 1 to 8, each of which is electrically connected to its neighbor by a suitable resistance; a handle shown in the "off" position in the diagram; a spring tending to hold the handle in the "off" position; an electromagnet whose armature is fastened to the handle; and three binding posts.

As soon as the switch is closed the field of the motor controlled by the starting rheostat is energized but no current flows through the armature of the motor. To start the motor, move the rheostat handle to contact 1. Current will then flow through the armature of the motor. The handle should then be moved to contact 2, then to contact 3, etc., to contact 8. It will be observed that this movement of the handle cuts out successively the resistance between the contacts until when contact 8 is reached all the resistance of the rheostat is cut out of the armature circuit. With the exception of the number of sections of resistance in the circuit, the path of the current is the same no matter what contact the handle may rest on. When the handle is placed on contact 8 the armature fastened to it is attaracted by the electromagnet, which is energized by the field current. This attraction is sufficient to hold the handle on contact 8 against the pull of the spring. To allow the motor to come up to speed before all the resistance is cut out, the time of moving the handle from contact 1 to 8 should be approximately from 10 to 15 seconds. The handle should not be held longer than two or three seconds on any contact other than 8, owing to the liability of the resistance coils to become damaged by the heating effect of the current. If the voltage falls materially below the normal, the current through the electromagnet is decreased to such an extent that the magnet is no longer able to hold the armature mounted on the handle against the pull of the spring, and the handle therefore returns to the initial or "off" position. This feature constitutes the automatic no-voltage release. Its object is to protect the motor against the rush of current which occurs when the line voltage is restored, in the case of the failure of the line voltage, and consequent stopping of the motor.

The Telephone (Pls. VI and VIII), mounted on the carriage, known as the "gun" telephone in distinction from other instruments of this class in the fire-control system, is fastened near the rear end on the outside of the left chassis by means of steel braces. It consists of a cast-iron box having a door with a positive lock and a hole for a one-half inch pipe tapped in the bottom. There is an inner wooden box containing an induction coil and a condenser, and having a fixed tray to hold the head set.

The telautograph is no longer mounted.

An Outlet Box, furnished by the Signal Corps and installed by the Ordnance Department, is provided for the purpose of connecting the wiring on the carriage to the telephone and is located on the left chassis near the telephone. It has a cover which is attached by four screws and is made water-tight by a rubber gasket. There are three holes tapped in the bottom of the box, through the middle one of which the carriage wires enter. A cable is led out through one of the other two holes to the telephone. Within this box is a slate base on which are mounted binding posts, by means of which the carriage wires are connected to the cable leading to the instrument. This cable passes through a flexible, water-tight, metallic conduit which is provided with union connections at each end.

The Signal Corps furnishes and installs the cables, from the box to the instrument and its flexible conduit, and makes the connections within the box and instrument.

Shot Truck and Shot Tongs.—The ammunition is brought to the gun and the projectiles wheeled into the breech recess on ammunition trucks. Three are furnished with each carriage. The shot tray on which the projectile rests can be raised to a suitable height, and is so supported that it can be given the required angle of inclination to bring the axis of the projectile in alignment with the axis of the piece. A hydraulic buffer attached to the front edge of the top plate of the frame receives the shock of impact against the breech of gun and relieves undue strain on the truck.

The frame of the truck is built up mainly of angle irons riveted. The shot tray and cartridge shelves are of steel plate formed into shape. The truck is supported by four wheels, the front pair being large and most heavily leaded, all of which are rubber tired. It is provided with a brake on the two front wheels, arranged to be operated by hand by the man at the truck handles.

One pair of shot tongs is furnished for each trolley installed in a battery by the Engineer Department, and two spare tongs. They are made of forged steel riveted and bolted together. In order to provide tongs having the least possible height over all, they are designed to use a locking link, which must be operated to hold the arms in position on the projectile, and with a gripping dog or eyepiece, the inner toe of which is pressed against the top of the projectile by the upward pull in the eye, thus preventing it from slipping out endwise if not properly balanced.

General Remarks.—An elevating band for the gun to be mounted and the necessary tools and implements are furnished with each carriage. The pinch bars are placed on hooks on the sides of the chassis, and implements for the gun and carriage and the tools are, excepting those too large, neatly packed in an armament chest marked with the number of the carriage, etc., to the inside of the lid of which is affixed a list of the contents.

There are plates on the carriage indicating the direction of motion of the elevating handwheels and of the traversing and retracting cranks, also instruction plates for filling, etc.

Drainage holes are drilled in all pockets, and all axles, trunnions, and sliding bearing surfaces are provided with oil holes, closed by screw plugs.

The six main axle bearings, gun trunnions, gun-lever axle, and crosshead pins and the crosshead clips on the vertical guides are supplied with compression grease cups. These cups, by means of a spring-actuated cup leather plunger, automatically force the lubricant through the passages and distributing grooves under the bearing surfaces.

INSTRUCTIONS FOR ASSEMBLING THE CARRIAGE.

Implements.—The assembling of the carriage requires the use of such blocking, way planks, hydraulic jacks, ropes, and pulleys as are usually found at the forts. In addition to the above a derrick or pair of shears capable of lifting 8 tons will be found very useful.

General Remarks.—The size and weight of the carriage are such that it is not shipped with the chassis assembled to the racer, but, in shipment, consists of the following principal parts: Base ring, rear traverse circle, traversing rollers, racer, chassis, transoms, top carriage, counterweight, crosshead clips, gun-lever arms, elevating arms, sight standard with ladder and platform, dust guard, and minor parts.

In assembling the carriage no part should be directly struck with a steel hammer or sledge. Soft-metal drifts or copper or lead hammers should be used. In handling the parts care must be exercised that the finished surfaces do not become burred. Where two bearing surfaces are brought together it is necessary that both parts should be clean, smooth, and well lubricated.

The following description gives a statement of the order in which the parts should be assembled rather than the details of the operation:

Base Ring.—Move the base ring into position by means of skids and rollers. When the holes in the base ring are directly over the corresponding bolts, lower by means of jacks until the ring rests upon the platform, with the bolts as nearly central in the holes as possible, with the ring concentric around the counterweight well.

Leveling.—In the earlier carriages wedges were used for leveling, but as opportunities occur the wedges are to be replaced by leveling screws. Level the base ring by means of the leveling screws located near each holding-down bolt. Each leveling screw should bear against a 5 by 5 inch by ¾ inch thrust plate. *A sensitive machinist's level and accurate straightedge should be used in leveling the base ring. The level should always be reversed and the mean reading considered as the correct one.*

Remove rust and burrs from the bolt threads, oiling the threads and the faces of the nuts, and when the base ring has been accurately leveled the nuts of the holding-down bolts should be tightened around a little at a time, and not sufficiently to strain the base ring. The grouting of neat Portland cement should then be poured underneath the base ring. After the grouting has thoroughly set the nuts of the holding-down bolts should be further tightened, and the leveling screws should be backed off. When these operations have been completed the level of the base ring should be again tested to see that it has not been disturbed by the above operations.

REAR TRAVERSE RAIL.—The rear traverse rail should next be put in position, the joints made up, and the whole lowered without straining the joints, and should be leveled with the same care as exercised in the leveling of the base ring. It must be accurately located concentric with the base ring and in parallel horizontal plane. The caliper and leveling tool shown on Plate I should always be used to secure the necessary accuracy in its setting. Proceed with grouting and final tightening as with the base ring. The proper working of the carriage depends largely on the accuracy of the above work.

DISTANCE RINGS AND TRAVERSING ROLLERS.—Thoroughly clean the pintle, the lower roller path, and the traversing rollers before placing them thereon, using kerosene and emery cloth if necessary. Test the alignment radially of the slots by the use of a fine wire or fixture pivoted at the center of the distance rings. Do not place the distance rings on the rollers until these slots have been placed in practically perfect alignment. After the traversing rollers have been assembled they should be run around in each direction several times to see that they do not bind or run hard, and then should be protected by canvas until the racer is about to be lowered upon them.

RACER.—Thoroughly clean the upper roller path and pintle surface of the racer, move it into position over and lower into the traversing rollers, and assemble the dust guard as soon as practicable to protect the rollers and the roller path. After being assembled the racer should be traversed by hand to ascertain whether it is entirely free in its action.

TRAVERSE-WHEEL TRANSOM AND REAR TRAVERSE WHEEL.—The traverse-wheel transoms should next be put in position and the rear traverse wheels assembled thereto.

CHASSIS.—The chassis should next be moved into position and bolted to the racer and traverse-wheel transom. The transoms uniting the chassis should be placed in position and bolted to the chassis before tightening the bolts securing the chassis to the racer and to the traverse-wheel transom. All of these bolts should be tightened, just to pinch, after which tighten each in succession a little till all are under a sufficient initial tension not to work loose.

TRAVERSING GEAR.—The traversing-gear bracket should now be assembled over the center of the rear transom for use in future operations. Assemble the remaining parts of the gearing and the racer clip

Now carefully note that traversing wheels and rollers are evenly loaded, that crosshead guides are vertical in both directions, that chassis rails are level across and of the designated slope when tested at extreme right and left and front traverse.

Any variations found by these tests indicate imperfect setting of the base ring or traverse rail, which should be carefully examined and remedied, or else imperfect work on the carriage.

Bottom Plate.—Before placing the bottom plate in position blocking to support same should be carefully placed in the well with its top surface about 5 feet below the top surface of the racer, if gun is to be mounted over the parapet, and about 5 inches below if to be mounted from the rear. Place the bottom plate in position on this blocking and carefully level it. The blocking should be so arranged that the lower ends of the suspension rods will be accessible for the securing nuts after the counterweight has been assembled, and so arranged that it may be withdrawn from the pit through the manhole. The bottom plate should be located in correct position with respect to the crosshead guides by the use of a wooden templet or by taking measurements frum the crosshead guides to the suspension rod holes.

Counterweight.—Lower into position in succession the twelve plates of counterweight. The lower four plates have no cuts in edges and the next six plates have vertical cuts only, to clear chassis. The holes for the suspension rods must be carefully aligned.

Recoil Rollers and Top Carriage.—The chassis-rail top flanges should be thoroughly cleaned and any burrs removed, and the recoil rollers thoroughly cleaned and oiled before being put in position. After placing the rollers in position the top carriage roller paths and flanges should be thoroughly cleaned and carriage moved into position from the rear in order that the clips may engage under the flanges on the chassis. The top carriage should then be moved backward and forward on the rollers to see that it works freely. The front ends of the piston rods should be secured to the chassis, and the rear brackets should be assembled on the rods. The top carriage will usually be received with piston rods assembled, stuffing boxes packed, and cylinders filled with oil. Each stuffing box is packed with six rings of Garlock waterproof packing 0.75 inch square.

Gun Levers.—The gun levers should now be moved into position over the top carriage, and the suspension-rod shaft, suspension rods, and crosshead clips attached thereto. This necessitates removing one lever from the axle and again forcing it on, the operation probably requiring the use of small hydraulic jacks. Special care should be exercised to see that the bearing surfaces are not burred and that they are thoroughly cleaned and lubricated with No. 4½ grease before the above parts are assembled or the gun-lever axle lowered into their beds in the top carriage.

CROSSHEAD CLIPS AND SUSPENSION RODS.—While the gun-lever arms are being lowered into position the suspension rods should be carefully guided through the holes in the counterweight and the crosshead clips should be made to engage the crosshead guides. After the suspension rods have reached their proper position, the suspension-rod nuts and lock nuts should be added. It is of great importance that each rod should bear one-half the weight of the counterweight, and the nuts should be carefully adjusted to accomplish this. The distance from the lower end of the suspension rods to the securing nuts should be carefully measured to see that the nuts are screwed home an equal amount. They are at proper height when the space between the top of the twelfth plate and the suspension-rod shaft is about 3 inches.

GUN.—The gun should next be mounted upon the gun-lever arms. It may be brought up from the rear or brought over the parapet. Before lowering the gun into its trunnions, the bearings should be examined to see that they are in perfect condition, and should be coated with No. 4½ grease. The elevating band should now be assembled. *It should be located on the gun in such position that the centers of its trunnions are 96 inches from the centers of the gun trunnions when measured parrallel to the axis of the gun.* In order that it may be located with sufficient assuracy, its position should be verified by measurements on both sides of the gun. It is secured in position by means of set screws which pass through its trunnions and are let into the gun 0.125 inch. In case slipping of the band occurs steel pallets are set under the screws and the screws are seated 0.25 inch therein. It is advantageous to use ground emery and oil between the band and the gun to make the band grip more tightly. The gripping bolt should be set up as *tight as possible*, after which the set screws, already set into the gun, should be set up to *bottom*.

ELEVATING GEAR AND ELEVATING ARM.—The elevating gear and elevating arm may now be assembled. In order to get the elevating racks at the same relative height, level across their trunnions, then engage the pinions with the proper tooth in its space in the rack (this should be marked), and key them to the shaft without changing the level of the racks. To assemble the elevating arms, separate one arm from the truss, assemble the arms on the trunnions, then reassemble to the truss.

RETRACTING GEAR.—The retracting gear may now be assembled. After this, assemble the sighting standard and platforms, tripping mechanism, and any other parts that have not been assembled. The gun should now be retracted and the blocking removed from the pit, after which the gun should be permitted to go into battery slowly by unwinding the retraction ropes from the drum.

If it should ever be necessary to raise or lower the counterweight when the gun is not mounted, it must be done carefully by means of jacks and blocking. The cylinders can not be used as buffers to check the fall of the counterweight, except when the gun is mounted.

After the mounting has been completed the following points should be noted:

1. Traverse the carriage to the extreme position in both directions and elevate and depress gun to see that they move freely.
2. Clean out all oil holes and see that they are provided with oil plugs.
3. See that there is no hard bearing between rim bases and face of gun levers.
4. See that the elevating arm and band are properly assembled, the clearness on each side being the same, and the arm not sprung or twisted.
5. See that the chassis rails and crosshead guides have not been burred.
6. See that the retraction ropes are properly adjusted, follow grooves on drum, and are not twisted.
7. See that the dust guard does not bear against the distance rings or racer.
8. Adjust the counterweight until gun rises as promptly as possible into battery without striking the stops with violence, and noting that the counter-recoil buffers act efficiently.
9. See that the piston rods are parallel to the tops of the chassis rails and also to their inside edges.
10. See that the stops to limit the motion in azimuth and depression are properly placed for the particular emplacement.
11. See that the pawls engage simultaneously on each rack of the crosshead and that the tripping and safety tripping devices function properly.
12. Set the elevation pointer by the use of a clinometer supported by a rest in the muzzle of the gun and verify the graduation in degrees.
13. Orient the gun, add numbers to the degree marks on the azimuth circle, and adjust azimuth pointer to indicate correct azimuth. Muzzle at true south is 0° in azimuth and numbers are placed around clockwise to include 359.
14. Adjust the sight standard by means of the counter set screws so that the bar sight with its telescope will sight on the same distant point that an accurate telescope will when placed in the trunnion sight bracket or that is covered by the bore sight.

15. Note that the telescope bar sight on standard agrees with the elevation given by the clinometer supported by a rest in the muzzle of the gun.

16. Traverse the carriage to its extreme positions against the azimuth stops, and then haul the gun down to see that nothing will interfere with its recoil in these positions.

17. See that electrical connections have been properly made, by trying the motor and the lights.

CARE OF CARRIAGE—GENERAL INSTRUCTIONS.—Carriages should be traversed from time to time throughout their entire allowed movement. They should not be allowed to stand for long periods set at a particular azimuth, as this might cause uneven setting of the platform.

The habitual position of guns on disappearing carriages is "from battery," but at intervals the gun should be allowed to rise to the firing position and be elevated and depressed within the limits of the stops.

The action of the pawls should be tested before all firings to see that their action is not sluggish, due to weak springs or lack of lubrication.

It is especially required that all parts of carriages be kept free from rust at all times. If this be allowed to accumulate, its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, and emery cloth No. 1, being coarse enough for any ordinary rusting, should be used, the rust being softened, if necessary, by kerosene.

The retracting wire ropes should at all times be kept well oiled with light slushing oil.

If any leakage occurs from the hydraulic recoil system, it should be immediately remedied, calling if necessary upon the district armament officer for the services of skilled labor.

The repacking of stuffing boxes may be done, when necessary, by trained enlisted men under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition, and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months and thoroughly cleaned every six months.

INSTRUCTIONS FOR CLEANING RECOIL CYLINDERS.—For this cleaning a plumber's hand force pump will be supplied to each

Coast Artillery post, with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that in no case will it be necessary to remove the packing from a stuffing box to clean the cylinder.

In cleaning, the following order of operations may be followed:

(*a*) Run gun into battery and remove oil from hydraulic recoil system.

(*b*) Retract gun until pistons are in the middle of the cylinders; then slack away until the pawls engage in the ratchet teeth on the crosshead; observe that the pawls are properly engaged in the ratchet teeth and that the pistons are not under the filling holes.

(*c*) Remove the piston-rod brackets from the rear ends of the chassis rails. Take off the two nuts on the front end of each piston rod, remove the rear cylinder head from each cylinder, and carefully remove the rods rearward out of the cylinders. Before removing any part it should be marked so as to insure its being assembled in its correct position.

(*d*) Thoroughly clean each cylinder from both ends with kerosene oil forced in with a hand pump, then wipe dry with clean cotton waste. Clean the piston rods and stuffing boxes. The equalizing and connecting pipes should be dismounted and thoroughly cleaned by forcing kerosene oil into them with the pump.

(*e*) Assemble the equalizing and connecting pipes, leaving the throttling valve wide open. Insert each piston rod in its cylinder, exercising great care that it be neither bent nor damaged in any way and that the piston does not bind in or burr the walls of the cylinder. Assemble the two nuts on the front end of each rod. Place each rear cylinder head on its rod and move forward into its seat in the cylinder. Assemble the piston-rod brackets to the chassis, and then firmly secure the rear cylinder heads to the cylinders. Properly tighten the four followers of the stuffing boxes and fill the recoil cylinders with hydroline oil. This will require some time, as the oil can enter the parts of the cylinders in rear of the pistons only through the equalizing pipes and the throttling orifices. When apparently filled insert the filling plugs, close the throttling valve, and retract the gun to the loading position. Complete the filling of the cylinders and close the throttling valve to its proper setting.

Carefully inspect all parts dismounted and note that they have been properly assembled. Then trip the pawls and let the gun rise into battery.

The piston-rod nuts should then be loosened to insure the rod being centrally located in the cylinder and the nuts finally tightened.

The gun should be retracted and tripped several times to insure that all parts are in proper working order.

REMOVING PACKING FROM STUFFING BOXES (using new extractor furnished by the Ordnance Department).—Close the extractor around the piston rod and insert the locking pin. Turn the extractor to the left, with pressure on the packing, until the needles are firmly engaged in the packing. Draw the packing out, turning slowly to the left. In the case of a box with interior thread, and if the ring is tight, it shall be unscrewed and not stripped out by the thread, because unless unscrewed it would catch upon and be injured by the thread.

Extractor bars are provided to be used for starting the packing from its seat and by inserting the toes of the bars in the rack teeth and prying over the edge of the box, being careful not to injure the thread.

TO PACK OR REPLACE A STUFFING BOX.—Examine the old packing and discard all unfit for use. If any of the old packing is used it should be put in after the new.

To repack, put on the piston rod one ring of 0.75-inch Garlock's "waterproof hydraulic" packing and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of packing in a similar manner, being careful to break the joints, until six rings of new packing have been inserted, or an equal amount of new and old when any of the latter is used. Place the halves of the gland on the follower, enter them together in the box, and screw up the follower, being careful to note that the halves of the gland do not bind on the screw threads.

No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of a pipe to the end of the spanner wrench should not be permitted.

When the box is properly filled and the follower tightened, there should not be more than 1 inch of space between the flange of the follower and the piece into which the follower is screwed. The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the piston rod. When the follower is screwed in until the flange strikes the box, another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes of carriages when not in use. Also when tightening the followers a slight amount of oil will squeeze out of the saturated packing. This oil should be caught and not allowed to render the carriage unsightly.

FILLING RECOIL CYLINDERS.—Fill the cylinders with oil, removing for this purpose the two plugs, one in each cylinder. Pour clean neutral oil of specific gravity about 0.85 (such as the "hydroline" now issued to the service) into the hole in one cylinder until it flows out of the hole in the other. *Allow any air that may be present to* *escape, then pour in more oil, until the system is filled to the level of the filling holes.* About 40.5 gallons are required.

The cylinders will then be not full, but as nearly full as they are intended to be. The filling holes are intentionally placed below the highest point of the cylinders in order to leave above their level a void (or air space) equal to the volume of the counter-recoil buffer plus a few cubic inches to allow for expansion of the oil when heated by the weather or otherwise.

RECOIL CYLINDERS.—Experience has shown that recoil cylinders should not be emptied, as in that case the interior walls soon become dry and rusty.

OIL HOLES.—Oil holes, where provided, must be cleaned out frequently to keep them free from sand and grit, and will habitually be kept closed by the screw plugs or screws provided, except when in the act of oiling.

Before oiling at any oil hole, wipe off carefully any dirt or grit near the opening that might be carried down into the bearing by the oil.

COMPRESSION GREASE CUPS.—Where compression grease cups are provided, similar precautions against dirt or grit must be observed. In filling these cups, do not fill the cup completely, but fill only to the bottom of the bevel at the top of the cup; if too full, the leather packing will become inverted and will not act as effectively. In putting on the cap, see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup or otherwise. Screw the cap down on the cup, using a wrench if necessary to secure sufficient power, until the spring rod projects about a quarter of an inch above the top of the cap. Later, when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearings, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the spring rod does not project, it is an indication that the cup should be refilled.

SERVICE CONDITION (LUBRICATION, ETC.).—When the carriage is to be kept in readiness for service, and is in daily or frequent use, all bearing parts must be kept thoroughly cleaned and lubricated. Especial attention should be given to the lubricating of trunnion beds, rollers, pintle surfaces, shaft bearings, and sliding surfaces; gun-lever axle beds, crosshead pins, elevating rack, elevating-band trunnions, crosshead guides; and the elevating, traversing, tripping, and retracting mechanisms, including the teeth of all gears.

The above parts should be lubricated at frequent intervals, whether the carriage is maneuvered or not. When carriages are in use for daily *drills a thorough lubrication twice each week should be sufficient for all but the most severely used parts.*

Proper lubricating and cleaning of the traversing rollers and their paths are essential to free working of the carriage. The dust guards may be removed to oil the traversing rollers, or to clean them or the paths, or for other purposes.

It is expected that the four oil holes in the racer surface will be found sufficient for oiling the pintle surface. *When oiling the pintle through these holes the carriage must be traversed in order to distribute the oil throughout the whole circumference.*

It will occasionally be necessary to examine all ball and roller bearings to see that the dust guards are in proper place and that the rollers themselves are clean.

MOTOR EQUIPMENT.

1. Do not let the motor run at full speed near the limits of movement. It may be slowed down by moving the rheostat handle to an intermediate position if it should become necessary. This should not be done save in exceptional circumstances, however, and for only a few seconds.

2. The insulation resistance, voltmeter and ammeter readings, time of retraction, speed of motor, etc., should be observed and recorded.

3. So far as practicable, conductors and all electrical apparatus and parts, with their insulation, have been given good metal protection against water and mechanical injury. If water is found within any casing, attention should be given to the cover, gasket, or bushing.

4. Every connection should be made with bearing surfaces polished and soldered, and every binding screw should be lightly set up.

5. Before tripping the gun into battery, see that the retracting motor is out of gear. The lever should habitually be moved and pinned to its rear position just before retracting and returned to its forward position immediately after.

6. Keep all gears and working bearings freely lubricated with good mineral oil. The oil wells should be examined each day before equipment is used.

7. When the sliding contacts of switches, rheostats, etc., become roughened or blackened by long or improper use, smooth and clean them with fine emery and leave a trace of vaseline on the surface.

8. When delivering 4 horsepower, the armature current required by these motors is about 35 amperes. Usually the circuit breakers are set, and the lead fuzes are selected to operate at a current one-fourth greater. The circuit breaker on the switchboard should be set to open for a current one-fourth greater than the sum of the settings of the motor circuit breakers.

9. All conduits should be kept well painted with P. & B. paint.

10. The conductor resistance of any connection or contact should be at least as small as that of an equal length of adjacent conductor.

11. The insulation of the system on a gun should be over a megohm, and its amount can be found by means of a voltmeter.

If a voltmeter whose internal resistance is 15,000 ohms gives 105 volts between dynamo brushes and 5 volts between one side and ground, then the insulation of the other side is about $15{,}000 \times \left\{\frac{105}{5}\right\} - 1 = 300{,}000$ ohms.

A ground in the system can be localized in a general way by watching the deflection of a voltmeter connecting one side and ground while eliminating or adding in turn different parts of the circuit. After having by the voltmeter determined in a general way the locality of a leak in the system, the exact determination of the position should be made by using a magneto. For this purpose all power should be cut off from the section containing the leak and each wire of the section in turn disconnected from all others and tested by a magneto, one pole of which should be connected to ground and the other to the wire under test. If the insulation is good, no ring of the magneto bell will occur. In making the test, care should be taken that the ends of the wire do not accidentally become grounded after having been disconnected.

12. A starting rheostat like the one for the motor is unreliable if, when the voltage falls, the operating handle does not freely return to the "off" position. Failure to return may be due to roughened or unclean contacts, or to a weak spring on the instrument, or it may be due to the armature adhering to the no-voltage release magnet. A screw in the face of the armature regulates the distance from the magnet and in this way the promptness with which the handle will be released. It should be released when the speed of the motor has fallen one-third.

The contacts must be replaced after long use. Avoid striking the handle on the first step to see if there is a current.

13. Oil and dirt will, if not guarded against, soon collect in the interiors of motor and other iron boxes and affect the action of the whole system. *All of the mechanism therein must be kept clean,* all bearings oiled, and sliding contacts smoothed and slightly vaselined. Too much vaseline will increase the burning and blackening of the contacts.

14. Carbon dust from the brushes falling upon the commutator and adjacent parts of the motor is injurious. Pieces of cotton cloth placed against the commutator while running will remove the black deposit. A trace of vaseline should then be put on. If, with this care the commutator gets an even brown appearance and the carbons are firmly held under 1-pound pressure by their springs and bear squarely and evenly over its whole end surface, there will be little danger of sparking. If the end of the carbon does not bear evenly, draw back and forth a strip of No. 0 sandpaper slipped between the end and the commutator. Be sure to clean off the scrapings.

15. When through using the electrical retracting equipment, *the switch should be opened* and the rheostat handle turned to the "off" position if not already there.

Note.—For information regarding paints, oils, cleaning materials, and methods of using same, see Ordnance Department pamphlet, Form 1869. Annual allowances will also be found in this pamphlet. See also Circular 29, W. D., 1910.

LIST OF ARTICLES PACKED IN THE ARMAMENT CHEST FOR 10-INCH GUN, MODELS OF 1888, 1888 MI, AND 1888 MII, AND 10-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1894 MI.

For gun.

*1 box containing firing mechanism.
3 brushes, cleaning, for primer seat.
1 cloth, emery, 1 quire, No. 00.
2 drifts, bronze, 1 large, 1 small.
1 drill, gunner's.
1 file, flat, dead smooth, 8-inch.
1 file, round, second cut, 8-inch.
1 file, half-round, smooth, 8-inch.
1 file, three-cornered, 8-inch.
†3 files, pillar, No. 6, 6-inch.
†3 files, three-cornered, No. 4, 6-inch.
†3 files, half-round, smooth, 8-inch.
†3 files, round, smooth, 8-inch.
1 hammer, boilermaker's.
1 hammer, copper.
*1 lanyard, gunner's.
1 mallet, hand.
*1 mallet, long-handled.
1 plier, cutting, 1 pair.
*1 pouch, gunner's.
1 punch, pin.
1 punch, gunner's.
1 reamer, cleaning, for primer seat.
1 ring, for lifting breech plate.
1 scraper, metal.
*1 sleeve, gunner's, 1 pair.
*3 sponges, wagon.
1 screwdriver, for breech-plug screws.
1 screwdriver, bar, for sight and lock plate screws, hinge pin, oil hole, etc.
1 screwdriver, bar, for tray-latch catch screws, etc.
1 screwdriver, bar, for latch pivot, bronze bushing, etc.
1 tool, for housing of crank catch.
*4 twine, assorted, 4 balls.
*10 pounds, waste, cotton.
*2 pounds wire, copper, No. 12.
*2 pounds wire, copper, No. 16.
1 wrench, tit, for obturator.
1 wrench, pressure plug.
1 wrench, obturator nut.
1 wrench, screw, obturator nut clamp.
1 wrench, monkey, 12-inch.
1 wrench, monkey, 18-inch.

For carriage.

2 bolts, lifting, for stuffing-box washers.
2 extractors, for cylinder heads.
3 hooks, counterweight.
*1 oiler, one-quart, locomotive.
2 oilers, half-pint.

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* Packed loose in chest. † To be used on bruised breechblocks, no other files to be used thereon.

1 screwdriver, commercial, 5-inch blade.
*3 wrenches, spanner, for stuffing boxes.
1 wrench, box, for cylinder head.
1 wrench, double, 0.375 and 0.5 nuts.
1 wrench, double, 0.625 and 0.75 nuts.
1 wrench, double, 0.875 and 1 nuts.
1 wrench, double, 1.125 and 1.25 nuts.
1 wrench, double, 1.375 and 1.5 nuts.
1 wrench, double, 2 and 2.25 nuts.
1 wrench, single, for 2.5 nuts.

The following articles, being too large, are not carried in the chest:

2 bars, trip.
2 buckets, water.
2 wrenches for suspension rods.
2 wrenches for piston rods.

WEIGHT OF PRINCIPAL PARTS OF 10-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1894, MI, AS PREPARED FOR SHIPMENT.

Name.	Weight.
Chassis, racer, top carriage, transoms, traversing wheel transom (traversing wheels) and all gearing (assembled)	69,300
Base and distance rings	11,450
Racer	7,200
Traversing circle and racks	13,560
Elevating arms	1,555
Gun levers, with axle, crosshead, and suspension rods	15,190
Elevating band	735
Bottom plate for counterweight	1,905
Lead counterweight	79,900
Top carriage, with piston, etc	11,935
Chassis (right and left)	24,000
Front transom	1,000
Rear transom	1,860
Traversing wheel transom	4,170
Elevating counterbalance device	3,350
Tripping gear	500
Sight standard with bracket	2,200
Sight platform with ladder, rail, etc	2,150
Sight platform brackets and supports	1,200
Traversing wheels	470
3 shot trucks	2,553
Total weight of carriage, including lead counterweight	202,798

The parts following are listed alphabetically under the following headings:

Carriage proper.
Equalizing and throttling system.
Azimuth pointer.
Electric firing, lighting, and power.
Ammunition truck.
Shot tongs.
Lanyard attachment.
Grease cups.

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* Packed loose in chest.

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made.

MEANING OF ABBREVIATIONS IN COLUMN OF MATERIAL.

Br.	Brass	L.	Lead.
Bz.	Bronze.	Mg. I.	Magnet iron.
C.	Copper.	M. I.	Malleable iron.
C. I.	Cast iron.	M. M.	Molded mica.
C. R. S.	Cold rolled steel.	S.	Steel.
C. S.	Cast steel.	S. B.	Sheet brass.
F.	Felt.	S. R.	Soft rubber.
F. S.	Forged steel.	S. S.	Sheet steel.
F. V. F.	Flexible vulcanized fiber.	Sp. S.	Spring steel.
G. I.	Galvanized iron.	V. F.	Vulcanized fiber.
G. W. H. P.	Garlock waterproof hydraulic packing.	V. R.	Vulcanized rubber.
G. S.	German silver.	W. I.	Wrought iron.
H. R.	Hard rubber.	W. M.	White metal.

CARRIAGE PROPER.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	4	Axle collars	On traverse wheel axle	S.	
	1	Base ring	On concrete foundation	C. I.	
7C	17	Bolts	Right chassis to racer	S.	
21MA	3	do	In drum-shaft bracket, left	S.	With nuts.
21PA	3	do	In drum-shaft bracket	S.	Do.
21N	2	do	In connecting-shaft bracket, rear.	S.	Do.
34N	8	do	In pulley brackets	S.	
38J	1	Bolt	In maneuvering lever	S.	
	2	Bolts	For lever	S.	
40B	2	do	Telephone bracket (upper)	S.	Do.
40B	2	do	Telephone bracket (lower)	S.	Do.
	4	Bolts, 0.75 by 3.75	Securing handwheel bracket to left chassis.	S.	Do.
	1	Bolt, 1.25 by 19	Through friction band	S.	With 2 nuts.
7D	10	Bolts, fitted	Right chassis to transom	S.	With nuts.
6M	9	Bolts, hexagon, fitted.	Left chassis to transom	S.	Do.
	40	Bolts, special	In distance ring separators	S.	Do.
16G	6	do	For left sighting platform	S.	Do.
16H	10	do	do	S.	Do.
16J	4	do	do	S.	Do.
16K	4	do	do	S.	Do.
16L	2	do	do	S.	Do.
17B	2	do	Platform plate to ladder and brace.	S.	Do.
	4	Bolts, special, 1 by 12.	Securing buffer heads to brackets.	S.	With 4 standard nuts and 4 lock nuts.
	2	Bolts, special, 1 by 2.5.	Securing stops to elevating rack.	S.	
	2	Bolts, special, 1 by 4.25.	do	S.	
	2	Bolts, special, 6.625 long.	In stiffening rib	S.	Fitted.
	2	Bolts, special, 6.25 long.	do	S.	Do.
	4	Bolts, stud	Caps to top carriage	S.	With nuts.
	32	do	In rear cylinder head	S.	
	4	Bolts, stud, 1.125 by 5.75.	Caps to elevating arms	S.	With nuts and lock nuts.
	2	Bolts, stud, 8.5 long	In gun levers	S.	2 lock nuts with 2 standard nuts.
	2	Bolts, stud, 10.75 long.	do	S.	Do.
	16	Bolts, hexagon tap.	In roller caps	S.	
6L	17	Bolts, tap	Left chassis to racer	S.	
	4	do	Clips to racer	S.	
9D	24	do	For joint plate on rear traverse rail.	S.	For carriages without extension (9G).
9D	32	do	Rear traverse rail	S.	For carriages with extension (9G).
9N	40	do	Dust guard to racer	S.	
9J	32	do	Joint plates to dust guards	S.	
	2	do	Handle to gun lever	S.	
15G	5	do	Securing platform bracket to sight standard.	S.	
15C	4	do	For sight-arm bracket	S.	
17Y	2	do	For front ladder braces	S.	
17Z	2	do	Securing rear ladder left to chassis.	S.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
17J	2	Bolts, tap	Ladder to top carriage	S.	
17J	2	.....do	Handrail 17K to top carriage	S.	
17H	2	.....do	Securing platform brace to top carriage.	S.	
17NA	2	.....do	Ladder extension to right chassis.	S.	
17NA	2	.....do	Right chassis ladder to chassis	S.	
17NA	2	.....do	Right chassis platform brace to chassis.	S.	
21GA	4	.....do	In drum shaft bracket, cover	S.	
21M	2	.....do	In connecting shaft bracket, rear	S.	
23D	8	.....do	In rope clamps	S.	
23J	8	.....do	In sheave brackets	S.	4 in right and 4 in left bracket.
24U	2	.....do	For retraction hooks	S.	
26C	40	.....do	Traversing rack brackets to traversing racer.	S.	
26D	28	.....do	Traversing rack to brackets	S.	
26H	8	.....do	Traversing rack bracket extension to rail.	S.	
26J	5	.....do	Traversing rack extension to bracket.	S.	
26S	2	.....do	Traversing gear bracket to traversing wheel transom.	S.	
	4	.....do	In lever rests	S.	
30U	4	.....do	Securing bracket (30TZ) to left chassis.	S.	
30BA	2	.....do	In lever catch	S.	
31F	4	.....do	In intermediate shaft bracket	S.	
31N	3	.....do	In gear case	S.	
31P	3	.....do	.....do	S.	
33H	4	.....do	In traversing crank shaft bracket.	S.	
33L	4	.....do	In handwheel shaft bracket	S.	
33R	3	.....do	In shoulder rest	S.	
33S	3	.....do	.....do	S.	
33Q	3	.....do	For nut strip (33N)	S.	
34J	6	.....do	For guide bars	S.	
35T	3	.....do	Elevating disk bracket to chassis.	S.	
35L	2	.....do	In elevating pointer	S.	
38F	4	.....do	Securing motor bracket to racer.	S.	
39C	3	.....do	In pinion shaft gear guard	S.	
39E	1	.....do	In slow-motion traversing gear guard.	S.	
39F	2	.....do	.....do	S.	
	2	.....do	Pointer to chassis	S.	
	3	.....do	Lever bracket to chassis	S.	
	4	.....do	For bracket on chassis	S.	
40C	2	.....do	Telephone bracket, upper	S.	
40C	2	.....do	Telephone bracket, lower	S.	
15E	6	.....do	Securing sight standard to chassis.	S.	
15L	4	.....do	Securing platform standard to chassis.	S.	
	2	Bolts, tap, 0.375 by 0.75.	On lanyard cam	S.	
	2	Bolts, tap, 0.5 by 1.25.	For lanyard filling piece	S.	
	2	Bolts, tap	Clamp cam bracket to left chassis.	S.	
	4	Bolts, tap, 1.25 by 2.25.	Stop plate to elevating rack guide.	S.	
	14	Bolts throttling bar, 3⅜ inches long.	In top carriage	S.	Used on carriages without cylinder liners.
	24	Bolts, throttling bar, 3½ long.	.....do	S.	
	44	Bolts, tap, 1.25 by 3.5.	Securing rack guides to chassis.	S.	
	2	Bolts, tap, 1.5 by 6.25.	Securing elevating arms to transom.	S.	
	2	Bolts, tap, 1.5 by 7.5.	.....do	S.	
	32	Bolts, tap, 1.25 by 2.75.	Securing transoms to chassis	S.	
	4	Bolts, tap, 1.25 by 3.	Securing piston rod brackets to chassis.	S.	
	4	Bolts, tap, 1.25 by 6.25.	In elevating buffer bracket	S.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	2	Bolts, special tap, 1.5 by 7.5.	Through elevating band, engaging gun.	S.	
	2	Bolts, throttling bar, 2.687 long.	In top carriage	S.	For carriages having stiffening rib.
	2	Bolts, throttle bar, 3.062 long.	.....do	S.	
	6	Bolts, throttle bar, 5.125 long.	In top carriage cylinders	S.	Used only on carriages having cylinder liners; 5 only required on top carriage having stiffening rib.
	12	Bolts, throttle bar, 4.75 long.	.....do	S.	Used only on carriages having cylinder liners; 11 only required on top carriage having stiffening rib.
17X	2	Bolts, through	Securing front ladder to sighting platform.	S.	With nuts.
17X	2	.....do	Securing rear ladder, left, to sighting platform.	S.	Do.
17CA	12	.....do	Rail post to front ladder	S.	Do.
17CA	12	.....do	Rail post to rear ladder, left	S.	Do.
21KA	4	.....do	Pinion shaft bracket to left chassis.	S.	
21J	3	.....do	Pinion shaft bracket to right chassis.	S.	
24B	3	.....do	In pinion shaft gear cover	S.	With 3 nuts.
24B	4	.....do	In crank shaft gear cover	S.	With nuts.
24T1	2	.....do	For retraction hooks	S.	Do.
	3	.....do	In shipper fork bracket	S.	Do.
26E	3	.....do	Through traversing rack bracket segment.	S.	Do.
26K	1	.....do	Through traversing rack bracket extension.	S.	Do.
26R	2	.....do	Traversing gear bracket to traversing wheel transom.	S.	Do.
	6	.....do	In tripping shaft bracket	S.	Do.
32B	3	.....do	In pedal base	S.	Do.
33G	3	.....do	In traversing crank shaft bracket.	S.	Do.
38A	4	.....do	Motor to motor bracket	S.	Do.
38Z	3	.....do	In intermediate shaft bracket	S.	Do.
38H	2	.....do	In maneuvering lever arc	S.	Do.
	8	Bolts, through, 1.375 by 12.75.	Securing buffer brackets to chassis.	S.	Do.
	4	Bolts, through, 2 by 16.125.	.....do	S.	Do.
	1	Bolt, through, 2.5 by 7.25.	For clamping elevating band	S.	Do.
17G	1	Brace	Supporting top carriage platform.	S.	
17QA	1	.....do	Right platform ladder to chassis.	S.	With two 0.5 rivets.
17MA	2	Braces	Supporting right sighting platform.	S.	Bolted to chassis.
	2	.....do	On guide bars	S.	Riveted on.
30T2	1	Bracket	Bolted to left chassis	C. S.	
	1	.....do	For lever on left chassis	C. I.	
	1	.....do	For lever on right chassis	C. I.	
	1	Bracket, left	On left chassis	C. S.	For tripping shaft.
	1	Bracket, right	On right chassis	C. S.	Do.
35R3	1	Bracket (elevating pointer).	Bolted to left chassis	C. I.	
	1	Bracket for piston rod.	On right chassis	C. I.	
	1	.....do	On left chassis	C. I.	
25F	1	Brake lever	On brake lever pivot	F. S.	
21DA	1	Brake lever pivot	In drum shaft bracket, left	S.	Riveted in.
25A	1	Brake pin	In brake lever	S.	
25D	1	Brake strap	On brake wheel	S.	
25C	1	Brake wheel	On drum shaft	C. I.	
	2	Buffer bolts	In elevating buffer bracket	S.	With 2 standard nuts and 2 lock nuts.
	1	Buffer bracket, left.	Bolted to left chassis	C. S. No. 1.	
	1	Buffer bracket, right.	Bolted to right chassis	C. S. No. 1.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	8	Buffer cushions	On buffer bracket	Balata.	
	2	Buffer heads	.....do	C. S. No. 1.	
	6	Buffer plates	.....do	W. I.	
	2	Buffer springs	On elevating buffer bolt	Sp. S.	
6J	2	Bushings	In left chassis	Bz.	For pawl fulcrum.
6J	2	.....do	In right chassis	Bz.	Do.
6C	1	.....do	In left chassis	Bz.	For elevating mechanism.
6C	1	.....do	In right chassis	Bz.	Do.
6D	2	.....do	In left chassis	Bz.	Do.
6D	2	.....do	In right chassis	Bz.	Do.
6E	4	.....do	In left chassis	Bz.	For traversing mechanism.
6E	3	.....do	In right chassis	Bz.	Do.
7A	1	.....do	.....do	Bz.	Do.
	2	.....do	In rear cylinder head	Bz. No. 4.	
	2	.....do	.....do	Bz. No. 3.	
	2	.....do	In forward end of gun lever	Bz.	Forced.
	2	.....do	In gun levers	Bz.	In halves.
21Q	2	.....do	In intermediate shaft	Bz.	
21G1	1	.....do	In pinion shaft bracket, right	Bz.	
21L	1	.....do	In connecting shaft bracket, rear.	Bz.	
21H	1	.....do	In pinion shaft bracket, right	Bz.	
21JA	1	.....do	In pinion shaft bracket, left	Bz.	
22M	1	.....do	In clutch gear	Bz.	
26M1	2	.....do	In traversing gear bracket	Bz.	
26N1	1	.....do	.....do	Bz.	
26P1	1	.....do	.....do	Bz.	
26Q1	1	.....do	.....do	Bz.	
	2	.....do	On tripping shaft bracket	Bz.	
	2	.....do	In pawl levers	Bz.	
	1	.....do	In safety latch	Bz.	
30S	1	.....do	In clutch gear	Bz.	
31H	1	.....do	In clutch pinion	Bz.	
31E	1	.....do	In intermediate shaft bracket	Bz.	
31L	1	.....do	In gear case	Bz.	
33C	1	.....do	In traversing crank shaft bracket.	Bz.	
33D	1	.....do	.....do	Bz.	
33E	1	.....do	.....do	Bz.	
33K	1	.....do	In handwheel shaft bracket	Bz.	
34Q	2	.....do	In pulleys 34P	Bz.	
35E	1	.....do	In idler 35D	Bz.	
38Y	2	.....do	In intermediate shaft bracket	Bz.	
38FA	1	.....do	In maneuvering lever	Bz.	
	2	Bushings 2.25 outside diameter.	In pawls (crosshead)	Bz.	
	2	Bushings 2.375 outside diameter.	.....do	Bz.	
	16	Bushings 2.375 inside diameter by 2.875 outside diameter.	In recoil rollers	Bz. No. 1.	
	2	Bushings 2.625 inside diameter by 3.125 outside diameter.	.....do	Bz. No. 1.	
	2	Caps	On gun levers	F. S. No. 3.	
	2	Cap squares	On top carriage	C. S. No. 1.	
32D	1	Catch	In clutch pedal	S.	
32E	1	Catch pin	.....do	T. Bz.	
6K1	1	Chassis, left	On racer	C. S. No. 1.	
7B	1	Chassis, right	.....do	C. S. No. 1.	
19U	1	Clamp band stud	In left chassis	S.	Forced fit.
18C	1	Clamp cam	On clamp cam pivot	F. S.	
18D	1	Clamp cam bracket	Bolted to left chassis	C. S.	
18F	1	Clamp cam pivot	In clamp cam bracket	F. S.	
18B	1	Clamp lever	On clamp cam pivot	F. S.	
19Q	1	Clamp spring	On clamp spring bolt	Sp. S.	
34D	4	Clevises	On counterbalance ropes	F. S.	
34E	4	Clevis pins	Through clevis 34D	F. S.	
	4	Closing plugs, fig. No. 23.	In top carriage	Bz.	Used only on top carriage having cylinder liners.
	4	Closing plugs, fig. No. 28.	.....do	Bz.	For top carriages without cylinder liners.

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No	Name of part.	Location.	Material.	Remarks.
	1	Clutch	On connecting shaft	F. S. No. 3.	
25B	1	....do	On drum shaft	C. S.	
31C	1	....do	On intermediate shaft	F. S.	
	1	Clutch collar	On connecting shaft	F. S. No. 3.	
30R1	1	Clutch gear	On clutch pivot	C. S.	
22A	1	....do	On drum shaft	C. S. No. 2.	
30CA	1	Clutch lever extension.	On clutch lever	S.	To be used on old levers.
30L4	1	Clutch lever	On clutch lever pivot	C. S.	
32Q	1	....do	In traversing crank shaft bracket.	Bz.	
30W2	1	Clutch lever pivot.	In bracket 30T2	Bz.	
30H	1	Clutch lever spring.	On spring stud and clutch lever.	Sp. S.	
32C	1	Clutch pedal	In pedal base	S.	
30G1	1	Clutch pinion	On clutch pivot	Bz. No. 2.	
31G	1	....do	On intermediate shaft	F. S. No. 2.	
30J	1	Clutch pivot	In bracket 30T2	F. S. No. 2.	Drive fit.
32F	1	Clutch rod	From clutch pedal (32C) to clutch (31C).	S.	
32N	2	Clutch rod pins	In clutch rod	S.	
25N	1	Clutch spring	On clutch (25B)	Sp. S.	
21EA	1	Collar	On brake lever pivot	S.	
30K1	1	....do	On clutch pivot	Bz.	
30N	1	....do	On intermediate pivot	S.	
30Q	1	....do	On handwheel pivot	S.	
32S	1	....do	On intermediate shaft	Bz.	
32X	1	....do	On handwheel shaft	Bz.	
35Q	1	....do	On disk gear pivot	S.	
35N	1	....do	On idler gear pivot	S.	
	1	Connecting rod pivot.	In maneuver lever	S.	
21X	1	Connecting shaft	Outside of right chassis	F. S. No. 1.	
21K1	1	Connecting shaft bracket, rear.	Bolted to right chassis	C. I.	
	1	Connecting shaft collar.	On connecting shaft	S.	
22J	1	Connecting shaft gear.	On connecting shaft, lower end.	C. S.	
22H	1	Connecting shaft pinion.	On connecting shaft, upper end.	Bz. No. 3.	
16A	2	Corner plates	On left sighting platform	S. Pl.	
16R	1	Corner plate	....do	S. Pl.	
16T	1	Corner post foot, left.	....do	F. S.	With wrought-iron pipe standards riveted on.
16S	1	Corner post foot, right.	....do	F. S.	Do.
16P	1	Corner standard	....do	F. S.	
34K3	1	Counterbalance weight.	Suspended on rope 34C in guide bars.	C. I.	
32H	1	Counterweight	On clutch rod	C. I.	
	1	....do	On suspension rod	L.	Cut away at "A" and "B."
	6	....do	....do	L.	Cut away at "A."
	4	....do	....do	L.	Not cut away.
	2	Counterweight, thirteenth layer.	....do	L.	
	2	Counterweight, fourteenth layer.	....do	L.	
	2	Counterweight, auxiliary.	....do	L.	
	1	Counterweight, bottom plate.	....do	C. S. No. 1.	
21FA	1	Cover	Bolted to drum shaft bracket, right.	Bz.	
31M	1	....do	On gear case	C. I.	
	1	Crank, left	On tripping shaft	F. S.	
	1	Crank, right	....do	F. S.	
27Q	2	Crank shaft collars.	On traversing crank shaft	Bz.	
21AA1	1	Crank shaft	Through chassis	F. S.	
31J	1	Crank shaft gear	On traversing crank shaft	C. I. No. 2.	
24H	1	Crank shaft gear cover.	On connecting shaft bracket, (rear) and bushing.	C. I.	In halves.
22K	1	Crank shaft pinion.	On crank shaft (21AA1)	Bz. No. 2.	
34W	1	Crossbeam	Between elevating racks	C. S.	
	1	Crosshead clip, right.	On right chassis guide	C. S. No. 2.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Crosshead clip, left.	On left chassis guide	C. S. No. 2.	
19M	2	Direction plates	On elevating handwheel	B.	Marked "Elevate."
19N	2	do	do	B.	Marked "Depress."
24Q	1	do	On right chassis	Bz.	
35B	1	Disk gear	On disk gear pivot	Bz. No. 3.	
35P	1	Disk gear pivot	On elevating disk bracket	S.	
	8	Distance rings	For traversing wheel	Bz.	
	1	Distance ring, inner	For traversing roller	W. I.	
	1	Distance ring, center.	do	W. I.	
	20	Distance ring separators.	Separating distance rings	W. I.	
	4	Dowels	In stiffening rib	S.	See drawing 9-9-30
	4	do	do	S.	See drawing 9-9-31.
15K	2	Dowels, 0.842	In sight standard	S.	
	1	Dowel pin, 0.5 by 2.	In tripping dog	S.	
24V	1	Drain plug	In pinion shaft gear cover	Bz.	
24V	1	do	In crank shaft gear cover	Bz.	
24V	1	do	In gear case	Bz.	
35F	1	Driving gear	On hub of left spur gear	Bz. No. 3.	Forced on.
	8	Dust guards	On traverse wheel	S.	
	8	do	On traverse wheel transom	S.	
9K	1	Dust guard for traversing rollers.	Bolted to racer	S. Pl.	In four sections with joint plates, reinforces and rivets.
21A1	1	Drum shaft	Through chassis	F. S. No. 3.	
21LA	1	Drum shaft bracket, left.	Bolted to left chassis	C. S.	
21NA2	1	Drum shaft bracket, right.	Bolted to right chassis	C. S.	
22C	1	Drum shaft gear	On drum shaft pinion	C. I. No. 2.	
22E	1	Drum shaft pinion	On drum shaft	Bz. No. 2.	
16B	3	Elbows	On left sighting platform	M. I.	Railing fittings.
17S	2	do	On front ladder	M. I.	Do.
17S	2	do	On rear ladder, left	M. I.	Do.
17EA	2	Elbows, 0.75	On right sighting platform railing.	M. I.	Plain, 90°.
17FA	1	Elbows, 1	do	M. I.	Do.
17GA	1	Elbows, side outlet	do	M. I.	Do.
	1	Elevating arm, left.	Breech end of gun	F. S. No. 3.	
	1	Elevating arm, right.	do	F. S. No. 3.	
	2	Elevating arm, boxes.	Upper end of elevating arms	Bz. No. 1.	In halves.
	2	Elevating arm, caps	On elevating arms	F. S.	
	1	Elevating arm, transom.	Between elevating arms	C. S. No. 1.	
	1	Elevating band	On gun	C. S. No. 1.	
	2	Elevating buffer bracket.	Bolted to elevating rack guide	C. S.	
6H	1	Elevating clamp stop.	On left chassis	S.	
35A1	1	Elevating disk	Riveted to disk gear	C. I	
35U2	1	Elevating disk scale.	Riveted to elevating disk	G. S.	
19P	1	Elevating gear, left.	On elevating pinion shaft	C. S. No. 1.	
19R	1	Elevating gear, right.	do	C. S. No. 1.	
30A1	1	Elevating handwheel.	On handwheel pivot	Bz.	
19S1	2	Elevating pinions.	On elevating pinion shaft	F. S.	
19W2	1	Elevating pinion shaft.	Through right chassis	F. S. No. 2.	
19W2	1	do	Through left chassis	F. S. No. 2.	
	1	Elevating rack, left.	In guides on left chassis	C. S. No. 1.	
	1	Elevating rack, right.	In guides on right chassis	C. S. No. 1.	
	2	Elevating rack, buffer stops.	On elevating racks	S.	
	1	Elevating rack guide, left.	Bolted to left chassis	C. S. No. 1.	
	1	Elevating rack guide, right.	Bolted to right chassis	C. S. No. 1.	
	4	Elevating rack liners.	On elevating racks	Bz.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	2	Elevating rack stops.	In elevating racks	S.	Slotted head.
	2	Elevating rack stop plates.	Bolted to guides	W. I.	
32G1	1	End	On clutch rod, 32F	S.	
	3	Ends	On connecting rods	S.	
16M	2	Eyes	On left sighting platform	S.	For guard chain.
34A	2	Eyebolts	In counterbalance weight	F. S.	
19V	1	Filler piece	On intermediate shaft	Bz.	
	2	Filling instruction plates.	On top carriage	Bz.	One on right side and one on left side.
	2	Filling and vent tubes.	.....do	S.	Used only on carriages having cylinder liners.
	2	Filling and vent tube collars.	.....do	S.	Do.
	2	Followers	In front stuffing box	Bz.	
	2	.....do	In rear cylinder head	Bz.	
18A	1	Friction band	On friction drum	S.	In two parts.
18G	1	Friction drum	On intermediate shaft, 19X	C. I.	
17AA	6	Front ladder rail posts.	On front ladder	S.	
	2	Front stuffing boxes.	In top carriage	Bz.	
6F	5	Fulcrum pins	Two on right chassis and three on left.	S.	
6G	1	Fulcrum pin	On right chassis	S.	Tapped 1 inch.
	2	Gaskets	For front stuffing boxes	Leather.	On top carriage.
	2	.....do	For rear cylinder head	Leather.	Do.
	2	.....do	For filling and vent tubes	[illegible]	Used only on carriages having cylinder liners.
31K	1	Gear case	Bolted to intermediate shaft bracket.	C. I.	
	2	Glands	In front stuffing boxes	Bz.	On top carriage.
	2	.....do	In rear stuffing box	Bz.	Do.
16N	1	Guard chain complete.	On left sighting platform	S.	Consisting of chain, hook and ring.
34H1	1	Guide bar, left	Bolted to left chassis	S.	T bars.
34G1	1	Guide bar, right	Bolted to right chassis	S.	Do.
	2	Gun levers	Resting in top carriage trunnions.	C. S. No. 1.	
	1	Gun lever axle	Through gun levers	F. S. No. 3.	
	1	Handrail complete	On left sighting platform	W. I. pipe.	In sections.
	2	.....do	On front ladder	W. I. pipe.	
	2	.....do	On rear ladder, left	W. I. pipe.	
17K	1	.....do	Bolted to top carriage	S.	
	1	.....do	For right sighting platform	W. I. pipe.	Do.
	1	Handle	On right gun lever	W. I.	
38K	1	.....do	For maneuvering lever bolt	S.	
18K1	1	Handwheel bracket	Bolted to left chassis	C. S.	
18J	1	Handwheel pinion.	On handwheel pivot	Bz.	
30E	1	.....do	.....do	Bz. No. 2.	
18E	1	Handwheel pivot	In handwheel bracket, 18K1	F. S.	Drive fit and pinned.
30P	1	.....do	In bracket, 30T2	F. S. No. 1.	Drive fit.
32W	1	Handwheel shaft	Through handwheel shaft bracket on sight standard.	F. S. No. 1.	
33J	1	Handwheel shaft bracket.	Bolted to sight standard	C. S.	
31A	1	Handwheel shaft pinion	On handwheel shaft, 32W	F. S. No. 2.	
	1	Hub for elevating handwheel.	Forced on hub of handwheel pinion.	C. I.	
35D	1	Idler	On idler gear pivot	C. I. No. 1.	
38S1	1	Idler gear	In maneuvering lever, 38T2	Bz. No. 3.	
38M1	1	Idler gear pivot	In elevating disk bracket	S.	
38L	1	Idler pivot	In maneuvering lever	S.	
	1	Inside connecting rod.	Between chassis	W. I. pipe.	
30X	1	Intermediate gear	On intermediate pinion	C. I. No. 1.	Forced fit.
30Y	1	Intermediate pinion.	On intermediate pivot	Bz. No. 2.	
30M	1	Intermediate pivot	In bracket, 30T2	F. S. No. 1.	Drive fit.
19X	1	Intermediate shaft.	Through chassis	F. S. No. 2.	
21P	1	.....do	Between chassis	C. S. No. 2.	
32B	1	.....do	Through brackets on sight standard and chassis.	F. S. No. 1.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
38AA	1	Intermediate shaft.	In intermediate shaft bracket...	F. S.	
38X	1	Intermediate shaft bracket.	Bolted to left chassis...........	C. S.	
31D	1	.....do............	Bolted to sight standard.......	C. I.	
18H	1	Intermediate shaft gear.	Keyed to friction drum hub....	C. S.	
22B	1	.....do............	On intermediate shaft, 19X.....	C. S.	
38V	1	.....do............	On intermediate shaft..........	C. S. No. 2.	
31B	1	.....do............	On intermediate shaft, 32R1, upper end.	C. I. No. 2.	
19T	2	Intermediate shaft pinions.	In intermediate shaft, 19X.....	Bz.	
38P1	1	Intermediate shaft pinion.	.....do........................	F. S. No. 3.	
22D	1	.....do............	On intermediate shaft, 19X.....	F. S. No. 3.	
9C	3	Joint plates........	On under side of rear traversing rail.	St. Pl.	For carriages without extension, 9G.
9C	4	.....do............	.....do........................	St. Pl.	For carriages with extension, 9G.
	2	Keys..............	Racer and chassis..............	F. S.	
	2	.....do	In gun lever axle..............	F. S. No. 3.	
	1	.....do.	Securing inner gear to friction drum hub.	S.	
	1	.....do	For clamp lever and clamp cam.	S.	
	1	.....do............	For elevating handwheel, 19A1.	S.	
	8	.....do............	For elevating pinion shafts.....	S.	
21R	2	.....do............	In intermediate shaft, 21P......	S.	Staked in.
	1	.....do............	In drum shaft pinion...........	S.	
25Q	2	.....do............	In shipper rod.................	S.	Riveted in.
30F	1	.....do............	In handwheel pinion............	S.	
30Z	1	.....do............	In intermediate pinion.........	S.	
32V	2	.....do............	In intermediate shaft..........	S.	Riveted.
32U	1	.....do............	.....do........................	S.	
32Y	1	.....do............	In handwheel shaft.............	S.	
38M	1	.....do............	In idler pivot.................	S.	Staked.
38CA	1	.....do............	In intermediate shaft, 38AA....	S.	
38DA	1	.....do............	.....do........................	S.	
38EA	1	.....do............	In motor shaft.................	S.	
	1	.....do............	In connecting shaft pinion.....	S.	
	1	.....do............	.....do........................	S.	
27H	2	Keys, 1.625 long...	In intermediate shaft..........	S.	
27C	2	Keys, 2.25 long....	In traversing pinion shaft......	S.	
21C	1	Key, 2.25..........	In drum shaft..................	S.	
21CA	1	Key, 2.5...........	In crank shaft.................	S.	
27B	2	Keys, 2.75 long....	In traversing pinion shaft......	S.	
27G	2	.....do............	In intermediate shaft, traverse.	S.	
21Z	1	.....do............	In connecting shaft............	S.	
21Z	1	.....do............	In crank shaft.................	S.	
21W	1	Key, 3 long........	In pinion shaft, 21S...........	S.	
21BA	1	.....do............	In crank shaft.................	S.	
21Y	1	Key, 3.25 long.....	In connecting shaft............	S.	
	2	Keys, 3.437 long...	In intermediate shaft..........	S.	
21U	1	Key, 3.75 long.....	In pinion shaft, 21S...........	S.	
27N	1	Key, 3.875 long....	In traversing crank shaft.......	S.	
21V	1	Key, 4 long........	In pinion shaft, 21S...........	S.	
	1	Key, 6.062 long....	In intermediate shaft..........	S.	
21D	2	Keys, 14 long......	In drum shaft..................	S.	With two rivets.
21E	2	Keys, gib..........	.....do........................	S.	
	2	.....do............	In tripping shaft..............	S.	
	2	.....do............	For tripping levers............	S.	
27P	1	Key, 2.875 long....	In traversing crank shaft.......	S.	
	1	Lanyard cam.......	On elevating arm...............	Bz.	
	1	Lanyard filling piece.	Bolted to elevating band.......	Bz.	
	1	Latch stud.........	In safety latch................	S.	
	16	Leveling screws....	In base ring...................	Bz. No. 3.	
9F	20	.....do............	In rear traverse rail...........	Bz. No. 3.	
9F	5	.....do............	In rear traverse extension......	Bz. No. 3.	
	1	Lever.............	On left chassis................	C. S.	
	1	.....do............	On right chassis...............	C. S.	
30AA	1	Lever catch........	On left chassis................	C. S.	
	2	Lever rests........	On right and left chassis.......	Sp. S.	
	4	Liners, 2⅛ inches wide.	On crosshead...................	T. Bz.	
	4	Liners, 2¼ inches wide.	.....do........................	T. Bz.	
	2	Liners, 8¾ inches wide.	.....do........................	T. Bz.	

*Names of parts of 10-inch disappearing carriage L. F., model of 1894 M*I*, their piece marks, location, and material of which they are made*—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	6	Liners	For top carriage	Bz.	
	8	.....do	For piston	Bz.	
	2	.....do	For recoil cylinders	Bz. No. 2.	For use where necessary.
	1	Liner, left	On crosshead	T. Bz.	
	1	Liner, right	.....do	T. Bz.	
	2	Links	Connecting cranks to pawl levers.	F. S.	
	4	Link pins	In tripping links	S.	
	2	Lock nuts	On piston rod	S.	
23F	2	Loops	On retracting ropes	F. S.	Secured with steel pins, 23Q.
	1	Maneuvering connecting end.	On outside connecting rod	S.	
38T2	1	Maneuvering lever.	Pivoting on intermediate shaft bracket.	C. S.	
38G	1	Maneuvering lever arc.	Bolted to left chassis	C. I. No. 2.	
38GA	1	Maneuvering lever stop.	In left chassis	S.	Drive fit.
	1	Motor	On motor bracket	Com.	4-horsepower, 625 r. p. m.
38E	1	Motor bracket	Bolted to racer	C. I.	
38Q	1	Motor shaft pinion.	On motor shaft	F. S. No. 3.	
	1	Notch number plate, right.	On right crosshead clip	Bz.	
	1	Notch number plate, left.	On left crosshead clip	Bz.	
	4	Nuts	On suspension rod	F. S. No. 3.	
44K	1	Nut	In azimuth pointer body	Bz.	
	2	Nuts	On piston rods	S.	
17F	4	.....do	On top carriage platform rail	S.	
	1	Nut, 1.5	On handwheel pivot	S.	
	1	Nut, 0.75	On clamp cam pivot	S.	
	1	Nut, 1.25	On clamp band stud	S.	
	2	Nuts	On intermediate shaft	S.	
21B	1	Nut, 2	On drum shaft	S.	
21T	1	Nut, 1.5	On pinion shaft	S.	
23M	2	.....do	On sheave pivot	S.	
25J	1	Crown nut, 0.75	On shipper rod	S.	
27E	2	Nuts, crown	On traversing pinion shaft	S.	
27L	2	.....do	On traversin intermediateshaft	S.	
32T	1	Nut, crown 1	On intermediate shaft	S.	
25J	2	Nuts, crown 0.75	On handwheel shaft	S.	
17PA	8	Nuts, special	On right platform railing standard.	S.	
38BA	1	.....do	On intermediate shaft	S.	
34B	2	Nuts, square special, 1.	On eyebolts, 34A	S.	
17N	2	Nuts, standard, 1	For step, 17M	S.	
25R	1	Nut, standard	On shipper fork pivot	S.	
	1	Nut, standard, 1	On safety latch fulcrum	S.	
	1	Nut, standard, 1.5	.....do	S.	
17N	4	Nuts, standard, 1	On spring rod, 34U	S.	
17N	2	.....do	On eyebolts, 34A	S.	
34T	2	Nuts, standard, 125	On pulley pivot	S.	
34T	1	.....do	On idler pivot	S.	
33N	1	Nut, strip	On shoulder rest	Bz.	
Q3C	6	Oil plugs, 0.375	In left chassis	Bz.	
	4	Oil plugs, 0.625	In racer	Bz.	
Q3C	6	Oil plugs, 0.375	In right chassis	Bz.	
	4	Oil plugs, 0.625	In traverse wheels	Bz.	
	8	.....do	In traverse wheels, axle	Bz.	
	4	.....do	In gun levers	Bz.	
	2	Oil plugs, 0.375	Elevating arm box	Bz.	
	2	.....do	Elevating arm, lower bearing	Bz.	
Q3C	1	.....do	In handwheel pinions	Bz.	
Q3C	1	.....do	In drum shaft	Bz.	
Q3C	2	.....do	In pinion shaft bracket, right	Bz.	
Q3C	1	.....do	In pinion shaft bracket, left	Bz.	
Q3C	1	.....do	In connecting shaft bracket	Bz.	
Q3C	1	.....do	In drum shaft cover	Bz.	
Q3C	1	.....do	On clutch gear	Bz.	
Q3C	1	.....do	On intermediate shaft pinion	Bz.	
Q3C	1	.....do	On intermediate shaft gear	Bz.	
Q3C	1	.....do	On drum shaft gear	Bz.	
Q3C	2	.....do	In sheave pivots	Bz.	
Q3C	1	.....do	In pinion shaft gear cover	Bz.	
Q3C	1	.....do	In crank shaft gear cover	Bz.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
Q3C	1	Oil plugs, 0.375	In traversing gear bracket	Bz.	
Q3C	1	.....do	In safety latch	Bz.	
Q3C	2	.....do	In tripping shaft bracket	Bz.	
Q3C	2	.....do	In pawl fulcrum pin	Bz.	
Q3C	1	.....do	In clutch gear	Bz.	
Q3C	1	.....do	In intermediate pinion	Bz.	
Q3C	1	.....do	In handwheel pinion	Bz.	
Q3C	1	.....do	In gear case cover	Bz.	
Q3C	1	.....do	In gear case	Bz.	
Q3C	3	.....do	In traversing crank shaft bracket	Bz.	
Q3C	18	.....do	In recoil roller axles	Bz.	
Q3C	1	.....do	In handwheel shaft bracket	Bz.	
Q3C	2	.....do	In pulleys, 34P	Bz.	
Q3C	1	.....do	In idler, 35D	Bz.	
Q3C	1	.....do	In disk gear, 35B	Bz.	
Q3C	1	.....do	In oil tube	Bz.	
Q3C	1	.....do	In intermediate shaft bracket	Bz.	
Q3C	1	.....do	In maneuvering lever arc	Bz.	
Q3C	2	.....do	.....do	Bz.	
	1	Outside connecting rod.	From maneuvering lever to lever on left chassis.	W. I. pipe.	1 inch.
38D	1	Oil tube	On left chassis	Br.	With brass collar soldered on.
24K	1	Pawl	On pawl pin	S.	
	1	Pawl, crosshead, right.	On pawl fulcrum, right	F. S. No. 3.	
	1	Pawl, crosshead, left.	On pawl fulcrum, left	F. S. No. 3.	
6A	1	Pawl fulcrum, right	In right chassis	F. S. No. 3.	
6B	1	Pawl fulcrum, left	In left chassis	F. S. No. 3.	
	2	Pawl fulcrum pins.	Through pawl fulcrum	F. S. No. 3.	
	1	Pawl lever, right	Connecting crosshead pawl to link on tripping shaft.	F. S. No. 3.	
	1	Pawl lever, left	.....do	F. S. No. 3.	
	2	Pawl lever studs	In pawl levers	S.	
24J	1	Pawl pin	In left chassis	S.	
	2	Pawl springs	Connecting crosshead pawl to pawl lever stud.	Sp. S.	
	2	Pawl spring studs	In crosshead pawls	S.	
	8	Pawl washers	For crosshead pawls	Bz.	
32A	1	Pedal base	On left sighting platform	C. I.	
32P	1	Pedal pivot	In pedal base	T. Bz.	
7E	2	Pinch bar hooks	On right chassis	S.	
7E	2	.....do	On left chassis	S.	
	2	Pins	In sheave pivot	S.	Driven.
	10	.....do	For bushings in traversing gear bracket.	Bz.	Do.
	3	.....do	In clutch gear bushing	Bz.	Do.
	2	.....do	In clutch pinion bushing	Bz.	Do.
	2	.....do	In intermediate shaft bracket bushing.	Bz.	Do.
	1	.....do	In gear case bushing	Bz.	Do.
	1	Pins, 0.25 diameter.	In bushing, 33D	Bz.	
	2	Pins, 0.375 diameter	In bushing, 33E	Bz.	
	2	Pins	In bushing, 33K	Bz.	
	4	.....do	In pulley bushing	Bz.	
34F	40	.....do	For counterbalance rope	S.	Tapered.
	4	.....do	In removable weights	S.	Cast in.
	2	.....do	In elevating disk bracket	S.	Riveted.
35S	1	.....do	.....do	S.	Drive fit.
	8	Pins, 0.375 by 1.75	In bushing, 6E	Bz.	
	8	Pins, 0.375 by 1.5	.....do	Bz.	
	16	Pins	In piston liners	S.	
	4	Pins 0.25 by 0.75	Securing filling and vent tubes.	S.	Used only on carriages having cylinder liners.
	3	.....do	Pinion shaft bracket, bushing, right.	Bz.	
	2	.....do	In connecting shaft bracket bushing, rear.	Bz.	
	2	.....do	In pinion shaft bracket bushing, right.	Bz.	
	3	.....do	In pinion shaft bracket bushing, left.	Bz.	
	3	.....do	In clutch gear bushing	Bz.	
	3	.....do	In intermediate shaft pinion	S.	
	3	.....do	In intermediate shaft gear	Bz.	
	3	.....do	Drum shaft gear to drum shaft pinion.	Bz.	

Names of parts of 10-inch disappearing carriage, L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Pins, 0.25 by 0.75	In shipper handle	S.	Riveted.
	2	.....do	In pointer, 35H4	G. S.	
	2	.....do	In idler bushing	Bz.	
35C	1	.....do	In disk gear	S.	Do.
	4	.....do	Through bushing in intermediate shaft bracket.	Bz.	
	1	.....do	For bracket, left	S.	
	1	.....do	For bracket, right	S.	
	3	Pins for end	In connecting rod ends	S.	
23Q	24	Pins, pointed	In retracting ropes	S.	
22F	1	Pinion	On pinion shaft	Bz. No. 2.	
21S	1	Pinion shaft	Through intermediate shaft and chassis.	F. S. No. 3.	
22G	1	Pinion shaft bevel gear.	On pinion shaft	C. S.	
21F	1	Pinion shaft bracket, right.	Bolted to right chassis	C. I.	
21HA	1	Pinion shaft bracket, left.	Bolted to left chassis	C. I.	
38U	1	Pinion shaft gear	On pinion shaft	C. S. No. 2.	
24A	1	Pinion shaft gear cover.	On pinion-shaft bracket, right	C. I.	In halves.
39B1	1	Pinion shaft gear guard.	Bolted to left chassis	S. An.	
	2	Pistons and rods	In top carriage cylinders	F. S. No. 3.	
	2	Plates	On guide bars	S.	Riveted on.
17LA	1	Plate	For right sighting platform	S.	
15H	1	Platform bracket	Bolted to sight standard	C. S.	
17A	1	Platform plate	For top carriage platform	S.	
15F	1	Platform standard	Bolted to left chassis	C. S.	
	4	Plugs	In top carriage for filling holes	Bz.	Includes 2 extra.
	2	Pointers	Bolted to right and left chassis	S.	
35H4	1	Pointer, elevating	On elevating disk bracket	Bz.	
35J	1	Pointer, service range.	In pointer, 35H4	G. S.	
35K	1	Pointer, subcaliber range.	.....do	G. S.	
16A	6	Post foot	For left sighting platform	F. S.	With wrought-iron pipe standards riveted on.
34P	2	Pulleys	In pulley brackets, 34M	C. I. No. 2.	
34M	2	Pulley brackets	Bolted to rear transom	C. S.	
34S	2	Pulley pivots	In pulley brackets, 34M	F. S.	
	1	Racer	On traversing rollers	C. S. No. 1.	
	1	Racer clip	On racer	F. S. No. 2.	
17E	1	Rail	On top carriage platform	S.	
22L	1	Ratchet wheel	On crank shaft, 21AA1	F. S.	
	2	Rear cylinder heads	In top carriage	C. S.	
17BA	6	Rear ladder rail posts.	On rear ladder, left	....	
9A	4	Rear traverse rails.	On concrete foundation	C. I. No. 2.	
9G	1	Rear traverse rail extension.	.....do	C. I. No. 2.	Use where required by emplacements.
	9	Recoil rollers	On right chassis	F. S. No. 3.	8 with 2.875 outside diameter bushing; 1 with 3.125 outside diameter bushing.
	9	.....do	On left chassis	F. S. No. 3.	Do.
	16	Recoil roller axles, 2.375 diameter.	Through recoil rollers	F. S. No. 3.	
	2	Recoil roller axles, 2.625 diameter.	.....do	F. S. No. 3.	
17KA	2	Reducers 1 by 0.75.	In right sighting-platform railing.	M. I.	
	1	Reinforce ring	Riveted to left sighting platform	S. An.	
34L	4	Removable weights	In counterbalance weight	L.	To use where necessary.
34X	2	Retaining pins	.....do	S.	
23P	2	Retracting ropes	Connecting rope drum to gun lever.	C. S.	Pliable.
24X	1	Retraction hook, right.	On right gun lever arm	C. S.	
24Y	1	Retraction hook, left.	On left gun lever arm	C. S.	
	1	Rim	For elevating handwheel, 19A1.	W. I.	
	2	Rings	On piston rods	F. S. No. 3.	Shrunk on.
	1	Rivet	Through handwheel bracket	S.	
	1	.....do	Through clamp cam bracket	....	

Names of parts of 10-inch disappearing carriage, L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	8	Rivet	For elevating handwheel, 19A1.	W. I.	
	8	do	For direction plates	Bz.	On elevating handwheel.
	12	do	Securing elevating disk to disk gear.	Bz.	
	48	do	Elevating scale to disk	G. S.	
	4	Rivets, countersunk	Through piston rod rings	S.	
	2	do	Through shipper rod keys	S.	
	2	do	In clutch lever extension	S.	
	2	do	For keys in intermediate shaft, 32R.	S.	
	6	do	In pinion shaft gear guard	S.	
	2	do	In slow-motion traversing gear guard.	S.	
	2	Rivets	In connecting rods	S.	
	6	do	In connecting ends	S.	
	10	Rivets, round head	In brake strap	S.	
	2	Rivets, 0.5 by 4.5	In bracket, 30T2	S.	
	2	Rivets, 0.375 by 3.75	do	S.	
	2	Rivets, 0.375 by 3.25	do	S.	
	8	Rivets, round head	Plates to guide bars	S.	
	4	do	Braces to guide bars	S.	
	72	Rollers	For traverse wheels	C. R. S.	
23R	2	Roller bearings	On drum shaft	S.	Commercial.
23S	2	do	In rope sheave	S.	Do.
	4	Roller caps	On distance ring	W. I.	For inside ring.
	4	do	do	W. I.	For outside ring.
34C	2	Ropes	Attached to counterbalance weight.	C. S.	
23C1	2	Rope clamps, right	On rope drum, right	S.	
23E1	2	Rope clamps, left	On rope drum, left	S.	
23B	1	Rope drum, right	On drum shaft	C. I. No. 2.	
23A	1	Rope drum, left	do	C. I. No. 2.	
23K	2	Rope sheaves	In sheave bracket	C. I. No. 2.	
17D	3	Rounds	In top carriage platform ladder.	S.	Riveted to side bars, 17C.
17SA	6	do	In right chassis platform ladder.	S.	
17VA	2	do	In right chassis ladder extension	S.	
	1	Safety latch	On safety latch fulcrum	F. S.	
	1	Safety latch fulcrum.	In right chassis	S.	
	1	Safety latch spring.	Connecting stud and safety latch	Sp. S.	
	1	Safety latch spring stud.	In right chassis	S.	
	1	Safety latch stop	do	S.	
	2	Safety latch washers.	On safety latch fulcrum	Bz.	
16U	1	Screen	Riveted to corner standard and screen connection.	S.	Consisting of 1 rear frame, wire, and rivets.
17DA	1	do	In right sighting platform frame.	S.	
16D	1	Screen connection.	On left sighting platform	F. S.	Riveted to handrail and standard.
	40	Screws, countersunk head.	Washers to traversing rollers	Bz.	
	16	Screws, countersunk, 0.75 by 1.5.	For trunnion bed liners	Bz.	
	40	Screws, countersunk, 0.375 by 0.875.	In top carriage liners	Bz.	
	20	Screws, countersunk, 0.375 by 2.72	do	Bz.	
	16	Screws, countersunk, 0.625 by 1.5.	In gun-lever bushings	Bz.	
	44	Screws, countersunk, 0.625 by 1.	Liners to elevating-rack guides	Bz.	
17TA	2	Screws, countersunk, 0.75 by 1.5.	Right platform ladder to chassis	S.	
	2	Screws, countersunk, 0.625 by 2.25	In tripping dog	S.	
	16	Screws, countersunk.	For notch number plate to crosshead.	Bz.	
	8	do	Liners to crosshead	Bz.	
	8	do	do	Bz.	
	24	do	do	Bz.	
	2	Screws, fillister head.	For front stuffing box	S.	
	4	do	In stiffening rib	S.	See drawing 9-9-30.
	4	do		S.	See drawing 31.
	2	Screws, headless, 0.5 by 0.75.	In rear cylinder head	S.	Securing Bz. No. 3 bushing.

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M$_I$, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	2	Screws, headless, 0.375 by 0.75.	In pawl fulcrum	S.	
38R	1	Screws, headless, 0.5 by 0.75.	For motor shaft pinion	S.	
38W	1	.....do	For intershaft gear	S.	
	224	Screws, round head	In dust guards and traverse wheel transom.	Bz.	
9M	4	Screws, round head, 0.25 by 0.75.	In traversing direction plates	Bz.	
	8	.....do	In filling instruction plates	Bz.	
24R	2	.....do	In direction plate, 24Q	Bz.	
38C	2	Screws, round head, 0.375.	For strip, 38B	S.	
23N	1	Screws, set, 1.25 by 1.75.	In rope drum, left	S.	
23N	1	....do	In rope drum, right	S.	
	2	Screws, set, 0.625 by 1.	In tripping levers	S.	
33F	1	Screw, set, 0.5	In traversing crank shaft bracket.	S.	
15J	2	Screw, set	In sight standard	S.	
	2	Screw, spline, 0.5 by 2.	Securing bushings to front end of gun levers.	S.	
	2	Screw pins, 0.625 by 1.125.	In rear cylinder head	S.	Securing Bz. No. 4 bushing.
38N	1	Screw plug	In idler pivot	S.	Forced.
23G	1	Sheave bracket, right.	Bolted to right chassis	CS.	
23H	1	Sheave bracket, left.	Bolted to left chassis	CS.	
23L1	2	Sheave pivots	Through sheave brackets, right and left.	S.	
25K	1	Shipper fork	Connecting clutch, 25B, with shipper rod, 25H.	CS.	
25E	1	Shipper fork bracket.	Bolted to front transom	CS.	
25L	1	Shipper fork pivot.	Through shipper fork bracket	S.	
25M	1	Shipper handle	On shipper rod	Bz.	
25H	1	Shipper rod	Through left chassis	S.	
33M	1	Shoulder rest	Bolted to sight standard	CS.	
17WA	2	Sides	For right chassis ladder extension.	S.	
17RA	2	Side bars	For right chassis platform	S.	
17C	2	.....do	For top carriage platform ladder.	S.	
17V1	1	Side bar, right	For rear ladder, left	S.	
17W1	1	Side bar, left	.....do	S.	
17Q	1	Side bar, right	For front ladder connection	S.	
17R	1	Side bar, left	.....do	S.	
15B1	1	Sight arm bracket.	On sight standard	CS.	
15A	2	Sight arm pins	Through sight arm bracket	Bz.	
15D	1	Sight standard	Bolted to left chassis	CS.	
16E	1	Sighting platform frame, left.	Resting on platform standard and platform bracket.	S. An.	
16F	1	Sight platform plate, left.	Riveted to platform frame	S. Pl.	
24F2	2	Sleeves	On traversing and retracting cranks.	Br. tubing.	
30C1	1	Sleeve	On stem, 30B	Bz.	
32L1	1	.....do	On stem, 32K	Bz.	
39A	1	Slow-motion elevating gear guard.	Pinned to intermediate pivot, 30M.	Bz.	
39D	1	Slow-motion traversing gear guard.	Bolted to traversing crank shaft bracket and chassis.	S. An.	
24L1	1	Speed handwheel	On crank shaft, 21AA1	Bz.	
35G	1	Spiral spring	For elevating disk	Sp. St.	With rivets.
	2	Split pins	Through taper pin in left chassis.	S.	0.203 by 1.25.
	2	.....do	Through taper pin in right chassis.	S.	0.203 by 1.25.
	4	.....do	Through traversing wheel axle collars.	S.	0.625.
	2	.....do	In sight arm pins	S.	
	1	.....do	For taper pin in brake lever pivot collar.	S.	
	1	.....do	For taper pin in pinion shaft bevel gear.	S.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 M1, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Split pins	Through taper pin in collar, 30N.	S.	
	1	.....do	Through taper pin in collar, 30Q.	S.	
	1	.....do	Through taper pin in crank shaft gear.	S.	
	1	.....do	Through taper pin in collar, 32S.	S.	
	1	.....do	For nut on intermediate shaft.	S.	
	2	.....do	For nut on handwheel shaft	S.	
	1	.....do	Through taper pin in handwheel shaft collar.	S.	
	4	.....do	Through clutch rod pins	S.	
	2	.....do	In pedal pivot	S.	
	2	.....do	In catch pin	S.	
	2	.....do	In traversing clutch fork pin	S.	
	4	.....do	In clevis pins	S.	
	1	.....do	In maneuvering lever	S.	
	1	.....do	In taper pin for gear guard	S.	
	1	.....do	Through taper pin in clutch	S.	
	6	.....do	Through pin for ends	S.	
	2	.....do	For pin	S.	
	2	.....do	.....do	S.	
	1	.....do	For taper pin in connecting shaft pinion.	S.	
	1	.....do	For taper pin in connecting shaft gear.	S.	
	1	.....do	For taper pin in crank shaft pinion.	S.	
	1	.....do	For taper pin in pinion, 22F	S.	
	1	.....do	For taper pin in ratchet wheel.	S.	
	1	.....do	For taper pin in speed handwheel.	S.	
	1	.....do	In brake pin	S.	
	1	.....do	For crown nut on shipper rod	S.	
	2	.....do	For crown nut on traversing pinion shaft.	S.	
	2	.....do	For crown nuts on intermediate shaft.	S.	
	2	.....do	For taper pins in crank shaft collars.	S.	
	1	.....do	For taper pin in traversing crank shaft pinion.	S.	
	4	.....do	For tripping link pins	S.	
	1	.....do	Through taper pin in clutch pivot.	S.	
	1	.....do	Through clutch pivot	S.	
	8	Spokes	For elevating handwheel	WI.	
34V	2	Springs	On spring rods	Sp. S.	
34U	2	Spring rods	Through cross beam	FS.	
30V	1	Spring stud	In bracket, 30T2	S.	
34R	2	Spring washers	On spring rod	CI.	
	4	Standards	For right sighting platform railing.	WI. pipe.	
	8	Staples	In thirteenth and fourteenth layers counterweight.	FS.	
30B	1	Stem	In handwheel, 30A1	S.	Riveted in.
32K	1	.....do	In handwheel, 32J1	S.	Do.
17P	8	Steps	For front ladder	S.	With 32 0.375-inch rivets.
17P	7	.....do	For rear ladder, left	S.	With 28 0.375-inch rivets.
17U	1	.....do	For front ladder	S.	With 4 0.625-inch rivets.
17W	1	.....do	For rear ladder	S.	Do.
17L	1	.....do	Screwed into fulcrum pin	S.	
17M	1	.....do	Through right chassis	S.	
	1	Stiffening rib, 9-9-30.	Bolted to top carriage	CI. No. 2.	On Bethlehem carriage No. 1 and Cramps No. 182.
	1	Stiffening rib, 9-9-31.	.....do	CI. No. 2.	For certain carriages having stiffening bar.
25P	4	Strips	On brake strap	S.	
38B	1	.....do	On left chassis securing oil tube.	Br.	
	1	Support	For slow-motion traversing gear guard.	S.	
	3	.....do	For pinion shaft gear guard	S.	
	2	Suspension rods	On suspension rod shaft	FS. No. 3.	

Names of parts of 10-inch disappearing carriage, L. F., model of 1894 MI, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Suspension rod, shaft.	Through gun levers and suspension rods.	FS. No. 3.	Engaging with crosshead.
	2	Taper pins	In left chassis	S.	0.842 by 7.875.
	2	do.	In right chassis	S.	Do.
	1	do.	In brake lever pivot collar	S.	
	1	do.	In pinion shaft bevel gear	S.	
	1	do.	In connecting shaft pinion	S.	
	1	do.	In connecting shaft gear	S.	
	1	do.	In crank-shaft pinion	S.	
	1	do.	In pinion, 22F	S.	
	1	do.	In ratchet wheel	S.	
	1	do.	In speed handwheel	S.	
	1	do.	In idler-gear pivot collar	S.	
	1	do.	In slow-motion elevating-gear guard.	S.	
	1	do.	Through collar on clutch pivot 30J.	S.	
	1	do.	Through collar on intermediate pivot.	S.	
	1	do.	Through collar on handwheel pivot.	S.	
	1	do.	In crank-shaft gear	S.	
	1	do.	In intermediate shaft collar 32S.	S.	
	1	do.	In handwheel shaft collar 32X	S.	
	1	do.	In elevating pointer bracket	S.	
	1	do.	In disk gear pivot collar	S.	
	1	do.	In clutch	S.	
	1	do.	Connecting shaft collar	S.	
	1	do.	In traversing crank-shaft pinion	S.	
	2	do.	In crank-shaft collars	S.	
16C	5	Tees	On left sighting platform	MI.	Railing fittings.
17T	4	do.	On front ladder	MI.	Do.
17T	4	do.	On rear ladder, left	MI.	Do.
17HA	1	Tee, 1	On right sighting platform	MI.	Plain.
17JA	1	Tee, 1, side outlet	do.	MI.	Do.
40A1	1	Telephone bracket, lower.	On sight standard	St. Pl.	
40F	1	Telephone bracket, upper.	do.	St. Pl.	
	4	Throttling bars	In top carriage cylinders	FS.	
	36	Thrust plates	Under leveling screws	S.	
	1	Top carriage	Movable on chassis	CI. No. 2.	Gun iron.
	1	Transom, front	Between chassis	CS. No. 1.	
	1	Transom, rear	do.	CS. No. 1.	
	4	Traverse wheels	In traverse-wheel transom	CS. No. 1.	
	4	Traverse-wheel axles.	Through traverse-wheel transom.	FS. No. 3.	
	1	Traverse-wheel transom.	Under rear end of chassis	CS. No. 1.	
33A	1	Traversing clutch-fork pin.	In traversing crank-shaft bracket.	S.	
27M1	1	Traversing crank shaft.	Through right and left chassis	FS. No. 1.	
33B	1	Traversing crank-shaft bracket.	On left chassis	CS.	
27R	1	Traversing crank-shaft pinion.	On traversing crank shaft	FS. No. 3.	
9B	2	Traversing direction plates.	On chassis	Bz.	1 right and 1 left.
32J1	1	Traversing handwheel.	On traversing handwheel shaft.	Bz.	
26L1	1	Traversing-gear bracket.	Bolted to traverse-wheel transom.	CI. No. 2.	
27F	1	Traversing intermediate shaft.	Through traversing-gear bracket.	FS. No. 1.	
27S	1	Traversing intermediate shaft gear.	On traversing intermediate shaft.	CS. No. 2.	
27U	1	Traversing intermediate shaft pinion.	do.	FS. No. 3.	
27T1	1	Traversing pinion.	On traversing-pinion shaft	Bz. No. 3.	
27A	1	Traversing pinion shaft.	Through traversing-gear bracket.	FS. No. 2.	
27V1	1	Traversing pinion-shaft gear.	On traversing-pinion shaft	CS. No. 2.	
26A	4	Traversing rack-brackets.	Bolted to rear traverse rail	CS.	

Names of parts of 10-inch disappearing carriage, L. F., model of 1894 M_I, their piece marks, location, and material of which they are made—Continued.

CARRIAGE PROPER—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
26F	1	Traversing rack-bracket extension.	Bolted to rear traverse-rail extension.	CS.	For use on carriages having extended traverse rail.
26B	4	Traversing rack segments.	Bolted to traverse-rack bracket.	FS.	
26G	1	Traversing rack-segment extension.	Bolted to traverse-rack bracket extension.	FS.	Do.
24C2	2	Traversing and retracting cranks.	For use on traversing and retracting crank shafts.	FS.	
24W	2	Traversing and retracting-crank fastenings.	On traversing and retracting cranks.	S.	Consisting of screw, eye, chain, ring, and taper split pin.
	20	Traversing rollers	Between racer and base ring	FS. No. 3.	
9E	2	Traversing stops	In rear traverse rail	S.	On traverse rail extension, 9G, where required.
	1	Tripping dog	On crosshead	S.	
	1	Tripping lever, right.	On tripping shaft	FS.	
	1	Tripping lever, left.	do	FS.	
	1	Tripping shaft	Through tripping-shaft brackets.	S.	
	2	Trunnion bed liners.	In top carriage	Bz.	In halves.
33P	......	Tube	On shoulder rest	......	Rubber without fabric.
	40	Verone washers	On distance-ring separator bolts	S.	
	20	Washers	On traverse rollers	Bz.	Secured with countersunk screws.
	1	do	On handwheel pivot	S.	
	1	do	On friction band bolt	S.	
	1	do	On clamp-cam pivot	S.	
	1	do	On clamp-band stud	S.	
	2	do	On intermediate shaft	S.	
21RA	2	do	Under connecting-shaft bracket.	S.	
21QA	2	do	do	S.	
	1	do	In crank-shaft gear cover	Felt.	
24G	2	do	On traversing and retracting crank.	S.	
	1	do	In brake wheel	Felt.	
25G	2	do	On shipper rod	S.	
27D	2	do	On traversing-pinion shaft	FS.	
27J	1	do	On traversing intermediate shaft.	S.	
27K	1	do	do	S.	
30D	1	do	On stem, 30B	S.	
32M	1	do	On stem, 32K	S.	
	38	do	For throttling-bar bolts	Lead.	
	2	do	For connecting-rod pivot	S.	
	6	do	For connecting-rod ends	S.	
	2	do	On pin	S.	
	2	do	do	S.	

EQUALIZING AND THROTTLING SYSTEM.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	2	Bolts, tap	Throttling valve to top carriage.	S.	
	2	do	Emptying coupling to top carriage.	S.	
	2	do	Equalizing-pipe straps to top carriage.	S.	
	8	Cylinder plugs	In top carriage	Bz. No. 4.	Including 2 extra.
H1B2	1	Disk	On valve stem, H1C	Bz.	
	1	Emptying coupling.	Bolted to top carriage	Bz.	
	2	Equalizing-pipe straps.	do	W. I.	
	1	Follower	In throttling valve	Bz.	
	6	Followers	On equalizing and throttling pipes.	Bz.	
	1	Gasket	On emptying coupling	Fiber.	
H1G	1	Gland	On valve body, H1N	Bz.	

Names of parts of 10-inch disappearing carriage L. F., model of 1894 MI, their piece marks, location, and material of which they are made—Continued.

EQUALIZING AND THROTTLING SYSTEM—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Latch	On throttling valve	Bz.	
	5	Packing rings	In throttling valve	Garlock hydraulic	1 for reserve.
	5	.....do	In buffer valve	Hydraulic.	Do.
	1	Padlock	On throttling valve	....	Yale standard No. 853.
	1	.....do	On buffer valve	....	Do.
	1	Pin	In valve stem, H1C	S.	Driven.
	2	Pipes, equalizing	On top carriage	Copper.	
	6	Pipes, throttling	.....do	Copper.	
	1	Pipe coupling, tapped.	On throttling pipe	Bz.	
	5	Pipe couplings, tapped, 1.625-inch.	On equalizing and throttling pipes.	Bz.	2.45 long.
	4	.....do	.....do	Bz.	2.1 long.
	1	Pipe connection, 1.85-inch outside diameter.	On throttling pipe	....	Consisting of steel ring, copper collar, and fiber gasket.
	15	Pipe connection, 1.48-inch outside diameter.	On equalizing and throttling pipes.	....	Do.
	1	Plug	In emptying coupling	S.	Do.
H1H1	1	Ring	On valve stem	S.	
	1	Rivet	In valve stem	Bz.	
	2	Rivets	.....do	Bz.	
	1	Screw, headless	Yoke to spindle	S.	
	1	Split pin	In valve stem, H1C	S.	
	2	Split pins	In stop latch pin	S.	
H1M1	1	Stop base	Bolted to top carriage	Bz.	
H1K	3	Stop base screws	In stop base, H1M1	S.	
H1L1	1	Stop latch	Pivoting on stop latch pin	Bz.	
H1F	1	Stop latch pin	In stop base	S.	
	1	Throttling valve body.	Bolted to top carriage	Bz.	
	1	Valve seat	In throttling valve	S.	
	1	Valve stem end	In valve stem body	S.	Riveted.
	1	Valve stem body	In throttling valve yoke	Bz.	
H1N	1	Valve body	For buffer valve	Bz. No. 4	
	1	Valve stem shank	.....do	Bz. No. 4	
	1	Valve stem tip	.....do	Fs. No. 1	
H1J	1	Valve seat	In valve body, H1N	Fs. No. 2	
	1	Yoke	On throttling valve	Bz.	

AZIMUTH POINTER.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
44E	1	Azimuth pointer body.	Bolted to traverse wheel transom.	Bz.	
	4	Azimuth strips	On rear traverse rail	Br.	Screwed with pins.
9N	1	.....do	On rear traverse rail extension	Br.	Do.
44B	2	Bolts, tap	Azimuth pointer to transom	S.	
44H	1	Collar	On azimuth pointer to screw	Bz.	
	3	Dowels	In azimuth pointer scale	S.	
44D	1	Index	On azimuth pointer body	Gs.	
44K	1	Nut	.....do	Bz.	
	1	Pin	In azimuth pointer screw	Gs.	
44A	1	Scale	In azimuth pointer body	Gs.	
44J	1	Screw	Through pointer to body	Bz.	
44C	1	Screw countersunk, 0.25.	In index	Gs.	
44G	2	Sleeves	On screw, 44J	Gs.	
44F	1	Slide	In azimuth pointer body	Bz.	
	1	Taper pin	In azimuth pointer sleeve	Gs.	
	2	Washers	On azimuth pointer bolts	S.	

Electrical equipment—10-inch D. C., model of 1894 Mɪ.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
P50C	1	Battery	In battery box		Made up of 6 No. 4 "OK" dry cells connected in series.
	5	Cell connections	Between battery cells		64 mils diameter, 7 strands.
P50D	12	Lugs	On cell and terminal connection.	C.	
	2	Terminal connections.	Battery to connection		Do.
P50A	1	Battery box	On bracket on chassis	Oak.	
P50E	1	Battery box connection.	On battery box	Bz.	
P50B	2	Bolts	Battery box and bracket	S.	
P50F	4	Hasps and hooks	On battery box	Br.	
P50K	2	Nipples	In battery box connection	Bz.	
	1	Bolt, tap	Strap, T21S	S.	
	9	.....do	Strap, T21D	S.	
	1	.....do	Strap, T21F	S.	
	1	.....do	Strap, T21R	S.	
	2	.....do	Shade, T68C	S.	
	2	.....do	Shade, T68B1	S.	
	1	.....do	Strap, T21G	S.	
	1	.....do	Pipe support, T21H	S.	
	2	.....do	Pipe brace, T21L	S.	
	2	.....do	Pipe support, T21M	S.	
	1	.....do	Pipe brace, T21N	S.	
	2	.....do	Pipe support, T21P1	S.	
	4	.....do	Junction box cover, T21K	S.	
	2	.....do	Plug box, E14A	S.	
	2	.....do	Hook, E14C	S.	
	4	.....do	Junction box cover, T21C	S.	
	1	.....do	Twisted hook, E12AA	S.	
	2	.....do	Firing pistol bracket to sight standard.	S.	See 15-OK-9.
	3	.....do	Box to bracket and bracket to chassis.	S.	Thread 0.875 long.
	2	.....do	Retracting controller to left chassis.	S.	Thread 1.25 long.
	4	.....do	Lamp shade, T68B1, to chassis.	S.	Thread 0.875 long.
	2	.....do	Lamp shade, T68C, to transom	S.	Do.
	2	.....do	Cover for lower trunnion box to base ring.	S.	Thread 0.75 long.
T68D	1	Bracket, battery box.	On left chassis and racer	S. Pl.	
T68A	1	Bracket, retracting controller.	On left chassis	S. An.	
	1	Bracket, firing pistol.	On sight standard	Bz.	See 15-O K-4.
V23DM	4	Bushings	2 to 0.5 connections	M. I.	
V23PM	1	.....do	From cross, V23FF, to 1.25 conduit on line to outlet box.	M. I.	
V23FM	3	.....do	From 2 to 0.75 connections	M. I.	
E12U	2	.....do	8-candlepower lamp fittings	Bz.	
V23NM	1	.....do	At cross, V23FF, on left chassis connection to conduit on sight standard.	M. I.	
E13AJ1	6	Candelabra receptacles.	At 8-candlepower lamps		125V ½ ampere.
E12S	2	Caps	On 8-candlepower lamp fittings.	Bz.	
	1	Retracting controller.	In controller box on brackets at rear of left chassis.		Holtzer Cabot design. See 14-0-8.
V23AA	5	Couplings	On 0.5 conduits	M. I.	Right and left.
V23BA	2	.....do	0.75 conduit at T21B1 to J. B. T21J1.	M. I.	Do.
V23CA	1	Coupling	At nipple V23CT to outlet box	M. I.	Do.
V23DA	1	.....do	From nipple V23WT at upper terminal box to outlet insulator V23CN.	M. I.	Do.
V23EA	6	.....do	On 2 conduit	M. I.	Do.
E12W	2	.....do	At 8-candlepower lamp	Bz.	
	1	Cover	Over lower terminal box	S. S.	See 14-6-19.
V23CF	3	Crosses	On 2 conduit	M. I.	
V23FF	1	Cross	At connection to conduit on sight standard.	C. I.	
V17P1	1	Elbow	Connection to lower terminal box.	C. I.	
	1	Firing pistol	On firing pistol bracket on sight standard.		
P39F1	2	Bolts, tap	1 in magnet header, 1 for spiral to buzzer board.	Br.	
P39D1	1	Binding bolt	In spring insulation	Br.	With 4 nuts chamfered on both sides.

Electrical equipment—10-inch D. C., model of 1894 M1—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
P39J	1	Binding post	On buzzer board	Br.	With set screw connected with binding stud.
P39X	1	do	do	Br.	With split end connecting with spiral.
P39W2	2	Binding-post screw	Binding post to buzzer board	S.	
P39Q	1	Binding screw	In binding post in contact with buzzer.	Br.	To hold connecting wires from binding stud.
P39AB	1	Binding stud	Molded in spring insulation	Br.	With platinized point for contact with trigger spring.
P39Z2	2	Bushings	In nipples in pistol cover	H. R.	Slotted to match nipple.
P39AF	1	Button gland	In pistol frame or push-button stem.	Br.	Knurled end.
P39AK2	1	Buzzer	On buzzer frame	Mgl. and Br.	Complete.
P39AS3	1	Buzzer board	On pistol cover	H. R.	
P39AQ1	2	Buzzer-board nuts	Molded in buzzer board	Br.	
P39AP1	2	Buzzer-board screws.	Buzzer board to pistol cover	Br.	Thread 0.25 long.
P39AC	1	Buzzer frame	On buzzer board and magnet poles.	Br.	
P39AL1	1	Buzzer-frame bolt	Buzzer frame to magnet header	Br.	Countersunk head.
P39V1	1	Buzzer-frame screw	Buzzer frame to buzzer board	S.	
P39AH	2	Buzzer pivots	In buzzer frame	S.	
P39Y1	2	Contact screw	In binding posts	S.	With platinum tip 0.031 ($\frac{1}{32}$).
P39AU	1	Filler piece	Under retainer catch on pistol cover.	S.	
P39T1	2	Header screws	Magnet header to buzzer board	S.	
P39AA1	2	Magnet bars	On magnet header	Mgl.	
P39AE	1	Magnet header	On buzzer board	S. I.	
P39AR	2	Magnet screws	Magnet bars to magnet header	S.	
P39US	2	Magnet spools	On magnet bars	H. R.	20 layers of single silk-covered copper wire on each spool.
P45C1	2	Nipples	In pistol cover under binding bolt and binding studs.	Bz.	One end slotted for screw driver.
P39N	2	Pistol bolts	Pistol frame to pistol cover	Br.	20 threads per inch United States standard head knurled.
P39A1	1	Pistol cover	On firing-pistol bracket	Bz.	Supporting part of firing pistol.
P39C1	1	Pistol frame	On pistol cover	Bz.	Housing and handle of firing pistol.
P39AD2	1	Push button	In pistol frame	Br.	With vulcanized-fiber tip.
P39AG1	1	Push-button spring	In pistol frame on push-button stem.	Br.	6 coils 0.187 ($\frac{3}{16}$) solid weight.
P39B2	1	Retaining catch	On pistol cover	S.	Tempered.
P39R1	1	Resistance spool	On buzzer board	H. R.	Wound with 72-inch G. S. wire.
P39AM3	1	Spiral screw	Spiral to spiral-screw nut molder in buzzer board.	Br.	
P39AN1	1	Spiral-screw nut	Molded in buzzer board	Br.	
P39P	1	Spool wood screw	Resistance spool to buzzer board.	Br.	Countersunk head.
P39H4	1	Spring insulation	On pistol cover	H. R.	
P39G	2	Spring-insulation screws.	Spring insulation to pistol cover.	Br.	
P39L3	1	Trigger	In pistol frame	Bz.	
P39M	1	Trigger pivot	In trigger and pistol frame	Br.	Thread 0.32 long.
P39K	1	Trigger spring	On spring insulation	Br.	Held down by binding bolt.
P39E2	1	Washer	On binding bolt in spring insulation.	Micanite.	
	1	Firing circuit, branch of.	Primer to safety-firing switch		64 mils diameter stranded wire with flexible conduit, 0.25 inside diameter.
	1	do	Ground on gun to safety-firing switch.		Do.
	1	do	Firing pistol to safety-firing switch.		Do.
	1	do	Battery to safety-firing switch		Do.
	1	do	Battery to firing pistol		Do.

Electrical equipment—10-inch D. C., model of 1894 MI—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
P45K	21	Bolts, tap	For straps P45Q, P45R, P45S	S.	
P45Z1	1	Contact-fork connection.	Firing-circuit terminal and connection to primer.	C.	
P45M3	12	Bushings	In swivels and nipples	H. R.	Forming part of terminal.
P45H	10	Nuts	On swivel on flexible conduit	Bz.	Do.
P45T	9	Plugs	In firing-circuit terminals	Bz.	Do.
P45P1	7	Receptacles	1 on ground connection, 2 on firing pistol, 4 on terminal attached to safety-firing switch.	Bz.	
P45J1	10	Sleeves	On ends of 0.25 flexible conduit	Bz.	
P45N1	12	Sockets	In bushings of firing-circuit branches and battery-box connection.	Bz.	
P45Q	16	Straps	On gun and carriage	S.	
P45R	1	.....do	On gun	S.	
P45S	2	.....do	On gun and carriage	S.	
P45G1	10	Swivels	On ends of 0.25 flexible conduit	Bz.	
P45AA1	12	Washers	In terminals and battery-box connection.	H. R.	
P45F	1	Ground connection.	Near breech of gun	S.	Connected with branch of firing circuit.
E14C	1	Hook	On left chassis used in connection with portable lamp.	Bz.	Bolts furnished by Ordnance Department.
T21B1	3	Junction boxes and covers.	2-conduit	C. I.	
T21J1	1	.....do	At junction to 8-candlepower lamp and portable lamp.	C. I.	
T73H	2	.....do	At connection to buffer lamp and lamp on left chassis.	C. I.	
T74Q	2	.....do	At connection to 16 candlepower lamp on transom and 16-candlepower lamp on right chassis.	C. I.	
E9H	2	Lamps	For sight	Comm.	2 candlepower, 106-116 volts.
E13AK or E13AL	3	.....do	Center and side of chassis	....	16 candlepower, 110 volts; or 16 candlepower, 220 volts.
E12NA	4	Lamps, candelabra.	At azimuth pointer, at buffer valve, at elevating disk, at throttling valve.	....	110 volts, 8 candlepower.
V23GT	2	Nipples, short	Coupling V23BA to junction box T21J1.	W. I.	Right and left insulation-lined.
V23VT	1	Nipple, close	Coupling V23EA to retracting controller.	W. I.	Do.
V23WT	1	.....do	Coupling V23DA to retracting controller.	W. I.	Do.
V23KT	4	Nipple, short	2-connection	W. I.	Do.
V23JT	1	.....do	Tee V23DC to coupling V23CA near outlet box.	W. I.	Do.
V23FT	3	.....do	Coupling V23AA to T21J1 (two places). Coupling V23AA to cross V23CF.	W. I.	Do.
V23AU	1	Nipple, long	Side outlet tee V23ED to switch E13Q1.	W. I.	
V23TT	1	Nipple, close	Coupling V23AA to junction box T73H.	W. I.	Right and left.
V23CT	1	Nipple, short	Coupling V23CA to outlet box	W. I.	Right-hand insulation-lined.
V23DT	2	.....do	Cross V23CF to retracting controller, cross V23CF to J. B. T21B1 on transom.	W. I.	Do.
E12T	4	Nuts	On lamp fitting and reflector E12P1.	Bz.	
	1	Outlet box	In rear of left chassis	....	Furnished by Signal Corps.
V23DN	1	Outlet insulator	Connections to controller box	Comm.	See H. Krantz Mfg. Co., Bulletin 2, p. 3.
V23CN	1	.....do	On conduit from upper terminal box.	Comm.	Do.
V23AN	3	.....do	On gun lever, on sight standard, on transom.	Comm.	Do.
T21F	1	Pipe strap	On 0.5 conduit to lamp at buffer valve.	S.	
T21G	1	.....do	On 1.5 conduit near cross V23FF on left chassis.	S.	
T21H	1	Pipe support	On 1.5 conduit from retracting controller to outlet insulator.	S.	

Electrical equipment—10-inch D. C., model of 1894 M1—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
T21L	1	Pipe brace	On 2 conduit near junction box T21B on left chassis.	S.	
T21M	2	Pipe supports	On 2 conduit on left chassis	S.	
T21N	1	Pipe brace	On 2 conduit near contact box.	S.	
T21P1	1	Pipe support	On 2 conduit near cross V23CF.	S.	
V23F	4	Pipe plugs	Cross V23CF (2 places) junction box T21B, side outlet tee V23ED.	C. I.	
V23D	1	Pipe plug	Tee V23DC	C. I.	
V23A	1	.....do	Tee connection to azimuth pointer lamp.	C. I.	
V23E	4	.....do	Junction box T21B1, cross V23FF, cross V23CF (2 places).	C. I.	
E14B	2	Plug boxes	On side of chassis		Furnished by the Engineer Department, bolts furnished by Ordnance Department.
E14A	1	Portable lamp	On left chassis		Furnished by the Engineer Department.
	1	Pipe, 2-inch	From elbow to upper terminal box.	S.	Loricated.
	1	.....do	From upper terminal box to box T21B1.	S.	Do.
	1	.....do	From box T21B1 to box T21B1 on left side of carriage.	S.	Do.
	1	.....do	From box T21B1 to V23FC	S.	Do.
	1	.....do	From V23FC tee to V23ED tee.	S.	Do.
	1	.....do	From V23ED tee to V23CF cross.	S.	Do.
	1	.....do	From V23CF cross to V23DN outlet insulator.	S. S.	Do. Do.
	1	.....do	From box T21B1 to box T21S1 at right side of carriage.	S.	Do.
	1	Pipe, 1.5-inch	From upper terminal box to V23CN outlet insulator.	S.	Do.
	1	.....do	From box T21B1 to V23FF cross.	S.	Do.
	1	Pipe, 1.25-inch	From V23FF cross to V23DC tee.	S.	Do.
	1	Pipe, 0.75-inch	From box T21B1 to box T21J1.	S.	Do.
	1	.....do	From V23CF cross to elevating scale lamp.	S.	Do.
	1	.....do	From V23FC tee to box T73H.	S.	Do.
	1	.....do	From T73H to throttling valve lamp.	S.	Do.
	1	Pipe, 0.5-inch	From V23FF cross to V23AN outlet insulator on sight standard.	S.	Do.
	1	.....do	From T73H box to plug box	S.	Do.
	1	.....do	From T74Q box to 16-candlepower lamps on right chassis.	S.	Do.
	1	.....do	From T73H box to 16-candlepower lamp on left chassis.	S.	Do.
	1	.....do	From V23CF cross to V23AN outlet insulator on transom.	S.	Do.
	1	.....do	From box T21B1 to box T74Q	S.	Do.
	1	.....do	From box T21J1 to plug box	S.	Do.
	1	.....do	From box T21J1 to azimuth pointer lamp.	S.	Do.
	1	.....do	From V23CF cross to T74Q box.	S.	Do.
	1	.....do	From T74Q box to 16-candlepower lamp on transom.	S.	Do.
	1	.....do	From V23AN outlet insulator to T73H box.	S.	Do.
	1	.....do	From T73H box to buffer valve lamp.	S.	Do.
E12P1	4	Reflectors	Over 8-candlepower lamp	S.	
	1	Retracting motor	Inside carriage on bracket		Robbins & Myer, 8-horsepower shunt wound motor.
	1	Safety firing switch	On left side of carriage,		
P30F	2	Blades	In front end of lever	H. C.	
P30E	1	Block	Front end of lever, on clip base	H. R.	
P34A	3	Bolts, tap	Lever base to chassis	S.	Threaded 1.25 long.
P34C	2	.....do	Clip base to lug on chassis	S.	Threaded 0.75 long.
P30S	6	.....do	Covers to stop and clip base	S.	Heads 0.5 flats, 0.25 thick.
P30N	1	Bushing	In lever	Bz.	

Electrical equipment—10-inch D. C., model of 1894 M1—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
P30D	4	Bushing	On blades and clip blocks in lever and clip base.	H. R.	
P34D	1	Clip base	On left chassis	C. I.	
P30G	2		In clip blocks	H. C.	
P30H	2	Clips	do	H. C.	2 right, 2 left.
P30J	2	Clip blocks	In end of clip base	H. C.	
P30P1	1	Cover	Onstop	S. S.	
P30Q1	1	do	On clip base	S. S.	Outer end planed.
P30T	1	Lever	On lever base	C. I.	
P34B	1	Lever base	On left chassis	C. I.	
P30R	1	Lever pivot	In lever and lever base	S.	Thread 1 long.
	8	Nuts	On terminal attachment	S.	Chamfered both sides, 0.25-inch tap, 24 per inch.
P30C	4	do	On shanks of blades and clip blocks.	S.	0.5 tap, 13 threads per inch.
	2	Pins	Stop to lever base	S.	Both ends riveted.
	2	do	Blocked in lever and clip base	S.	Driven.
	4	Pins, split	In shanks of blades and clip blocks.	S.	
	1	Spring cover	On lever	Sp. S.	No. 1 standard.
P30AB	1	Stop	On lever base	C. I.	
	1	Taper pin	Lever pivot and lever base	S.	
	1	Terminal attachment.	On clip base		See 14-5-51.
	1	do	On lever		Do.
P30B	1	Washer	On shanks of blades, clip blocks.	S.	
T68C	1	Shade	At 16-candlepower lamp on transom.	Fl. S.	
T68B1	2	Shades	On each side of chassis at 16-candlepower lamps.	Fl. S.	
E13AF	3	Sockets	At 16-candlepower lamps	Bz.	
E13AH	4	do	At 8-candlepower lamps	V. F.	Commercial.
E13AG	3	Socket holders	At 16-candlepower lamps	Bz.	
T21S	1	Strap	On 0.5 conduit near outlet insulator V23AN.	S.	
T21D	9	Straps	On 0.5 conduit	S.	
T21R	1	Strap	0.5 conduit near shade T68B1 on right chassis.	S.	
T21Q	2	Straps	On 0.75 conduit	S.	
E13Q1	1	Switch	Near side outlet tee on left chassis.		Do.
E13AE2	2	Switches, water-tight.	At elevating pointer lamp, at buffer valve lamp.		
	1	Swivel and drum	On inside of right chassis		
69B	2	Bolts, tap	Conduit clamp to drum	S.	Thread 1.5 long.
69R	14	do	Rope channel to bracket	S.	Thread 0.625 long.
69S	21	do	Rope channel to racer	S.	Thread 0.875 long.
69U	6	do	Drum hub to drum	S.	Thread 2 long.
69X	4	do	Drum shaft bracket to chassis	S.	Do.
69Y	4	do	Cap to drum shaft bracket	S.	Thread 1 long.
69AA	2	do	Swivel base to lower terminal box.	S.	Thread 2 long.
69Q	7	Brackets	Supporting rope channel	F. S.	
69K	2	Caps	Bolted to journal on drum shaft bracket.	C. I.	
69A1	1	Conduit clamp	Attached to drum	Bz.	In two pieces.
	1	Cover plate	To drum	SS.	
69F	1	Drum	Attached to drum shaft	C. I.	
69V	1	Drum hub	Attached to drum on drum shaft	Bz.	
69W	1	Drum shaft bracket.	Bolted to chassis	C. I.	
69P	1	Elbow	On drum shaft as point of conduit connection.	Bz.	
	1	Key	In drum shaft 69T	S.	Staked in.
69L	1	Lock screw	Attaching swivel to swivel base.	S.	Round head 16 threads per inch U. S. Standard.
Q3C	1	Oil plug	In elbow 69P	Bz.	See 30-2-3.
69H	6	Screws, round head.	Cover plate to drum	Bz.	0.625 thread.
69E	3	Screws, button head.	Swivel cover to swivel	Bz.	
69N	1	Shaft	On drum shaft bracket	S. D. S.	Tubing 2 outside diameter, 312 ($\frac{5}{16}$) thick.
69C	1	Spring	Outside spring support on drum shaft.	Sp. S.	Wound left hand.
69G	1	Spring holder	Outside spring on drum shaft	Bz.	
69J	1	Spring support	Inside spring on drum shaft	S.	5.25 outside diameter, 28.375 long., 0.248 thick.
69M	1	Swivel	In lower terminal box attached to swivel.	Bz.	Threaded to suit metallic conduit.

Electrical equipment—10-inch D. C., model of 1894 M1—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
69Z	1	Swivel base	Attached to swivel by lock screw.	C. S.	
69D	1	Swivel cover	To swivel	Bz.	
V23FC	1	Tee	On left chassis above junction box T21B.	C. I.	
V23DC	1	.....do	At connection to outlet box	C. I.	
V23AC	1	.....do	Azimuth pointer lamp	M. I.	
V23ED	1	.....do	2 conduit, left chassis near switch E13Q1.	C. I.	Side outlet.
	1	Telephone	Bolted to bracket on left standard.		Furnished by signal Corps.
V17R1	1	Terminal box, upper.	On transom	C. I.	Large size.
V17W	1	Terminal box, lower.	In recess in emplacement	C. I.	Do.
V17M1	2	Bases	In terminal boxes	Slate.	
V17K	22	Bolts	Through terminal and base	Bz.	Thread 1.25 long.
V17G	4	.....do	.....do	Bz.	Thread 1.5 long.
V17Q	4	.....do	.....do	S.	
V17T	16	.....do	Cover to terminal boxes	S.	Thread 0.875 long.
V17V	1	.....do	Elbow to lower terminal box	S.	Thread 1 long.
V17U	2	.....do	.....do	S.	Do.
V17CA	4	.....do	Cover V17BA to upper terminal box.	S.	Do.
V17S	2	Covers	On terminal boxes	C. I.	
V17BA	1	.....do	On upper terminal box	C. I.	
V17Z	40	Marking plates	On base	S. Br.	
V17AA	1	Nipples	Outlet from lower terminal box.	Bz.	
V17D	12	Nuts	On 0.375 bolts on base	Bz.	Chamfered on both sides.
V17J	66	.....do	On 0.25 bolts on base	Bz.	Do.
V17N	2	Pads	On cover V17S	S. R.	
	80	Pins	Marking plate to base	Br.	
V17X	2	Plates	On base	S. Br.	
V17E	4	Screws	Pad to cover V17S	Bz.	Round head.
V17Y	8	Screws, round head	Plate on base	Br.	
V17B	4	Terminals	On base	C.	For armature circuit.
V17C	4	.....do	.....do	C.	Do.
V17A	44	.....do	.....do	C.	For telephone circuit.
V17L	44	Washers	On 0.25 bolts on base	Bz.	
V17H	8	.....do	On 0.375 bolts on base	Bz.	
V17F	4	.....do	On screw pad to cover V17S	Bz.	
E12X	2	Thimbles	On gun lever supporting conduit.	G. I.	
E12Y	2	Twisted hooks	.....do	S.	
	1	Wire	In conduits from terminal box to lamps and plug box.	C.	64 mils diameter rubber covered and braided.
	1	.....do	In conduits from terminal box to retracting controller.	C.	162 mils diameter rubber covered and braided.
	1	.....do	In conduits from retracting controller to motor.	C.	Do.
	1	.....do	.....do	C.	64 mils diameter rubber covered and braided.
	1	.....do	In conduits from terminal box to outlet.	C.	64 mils diameter rubber covered and braided, twisted pair for telephone.

SHOT TRUCKS (3 PER CARRIAGE).

	1	Ball bearings	On elevating screws	S.	In halves, hardened
	2	.....do	On caster	S.	Do.
	36	Ball bearing balls	In elevating screw bearings	S.	0.5 diameter hardened.
	38	.....do	In caster bearings	S.	$\frac{5}{16}$ diameter hardened.
	2	Ball bearing covers.	On caster bearings	Bz.	
	2	.....do	On elevating screw bearings	Bz.	
	1	Bevel gear	Meshing with crank shaft gear	Bz.	Driven.
	1	.....do	On crank shaft	Bz.	Do.
	1	Bolt, tap	Lever center to crank shaft bracket.	S.	
	2	.....do	Caster bracket to frame	S.	

Electrical equipment—10-inch D. C., model of 1894 MI—Continued.

SHOT TRUCKS (3 PER CARRIAGE)—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	3	Bolts, through	Front axle to front support	S.	With nuts.
	4	.....do	Crank shaft bracket to frame	S.	Do.
	4	.....do	Caster bracket to frame	S.	Do.
	6	.....do	Brake shaft bracket to front support.	S.	Do.
	1	Brake lever	On brake lever shaft	S.	
	1	Brake shaft	Through brake shaft brackets	S.	
	1	Brake shaft bracket, left.	On front frame	Bz.	
	1	Brake shaft bracket, right.	.....do	Bz.	
	1	Brake lever guide	Riveted to rear frame	S.	
	1	Brake lever spring	Attached to lever and frame	Sp. S.	
	2	Brake shoes	On brake lever shaft	C. S.	1 right, 1 left.
	1	Buffer bracket	On top of truck, front	C. S.	Type of bracket varies with different trucks.
	2	Bushings	In guide ring	Bz.	Driven.
	2	.....do	In screw support	Bz.	
	2	.....do	In front wheels	Bz.	Do.
	2	.....do	In caster wheels	Bz.	
	2	.....do	In caster bracket	Bz.	Do.
	1	.....do	Forced in buffer bracket	S.	
	1	Cap	End of buffer plunger	Bz.	
	2	Cartridge shelf, front support.	Riveted to cartridge shelf and front support.	S. An.	1 right, 1 left.
	2	Cartridge shelf, rear supports.	Riveted to cartridge shelf and rear support.	S. S.	Do.
	1	Cartridge shelf, left.	Riveted to left side truck	S. S.	
	1	Cartridge shelf, right.	Riveted to right side truck	S. S.	
	1	Cartridge shelf, stiffener.	Riveted to cartridge shelf	S. S.	
	2	Cartridge, rear ends.	.....do	S. S.	
	1	Caster bracket, left.	Bolted to rear frame	C. S.	
	1	Caster bracket, right.	.....do	C. S.	
	2	Caster pins	In caster wheels	S.	
	2	Caster wheels	In caster yoke	C. S.	
	2	Caster yokes	In caster brackets	C. S.	
	1	Center shaft	Through top plate and screw support.	S.	
	1	Clutch gear	On rear elevating screw	Bz.	
	1	Clutch lever	Inside of truck	S.	
	1	Clutch lever handle	In clutch lever	S.	
	1	Clutch ring	Sliding on nut	S.	
	1	Crank	On crank shaft at side of truck	W. I.	
	1	Crank shaft	Through crank shaft bracket	S.	
	1	Crank shaft bracket	Bolted at side of truck	Bz.	
	1	Crank sleeve	On crank	Br.	
	1	Cylinder head	Front end of buffer bracket	Bz.	
	2	Corner plates, front	Stiffening frame	S.	
	2	Corner plates, rear	.....do	S.	
	1	Distance piece	On center shaft	S.	
	2	Elevating screw bodies.	Riveted to elevating screw head	S.	XX strong pipe.
	2	Elevating screw heads.	Hinged to shot tray	S.	
	1	Filler piece	Pinned to filler piece hinge	C. S.	
	2	Filling and drain plugs.	In buffer bracket	S.	
	1	Filler piece hinge	Riveted to shot tray	C. S.	
	1	Filler piece hinge pin.	Through filler piece and hinge.	Bz.	
	2	Followers	On cylinder head	Bz.	
	1	Front angle	Under cartridge shelf	S. An.	
	1	Front axle	Bolted to lower part of frame	F. S.	
	1	Front support	At front part of frame	S. An.	
	2	Front wheels	On front axle	C. S.	
	1	Gasket	Cylinder head and buffer bracket.	Fiber.	
	2	.....do	Filling and drain plugs	C.	
	2	Glands	In cylinder head	Bz.	
	2	Guide rings	On top plate for elevating screw.	F. S.	
	4	Handles	On truck handle	Hardwood.	Riveted to truc handle.
	2	Hinges for handles.	On sides of frame	W. I.	1 right, 1 left.
	1	Intermediate gear.	On crank shaft driven bevel gear	S.	
	2	Keys	Brake shoe to shaft	S.	

Electric equipment—10-inch D. C., model of 1894 M1—Continued.

SHOT TRUCKS (3 PER CARRIAGE)—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Keys	In nut	S.	
	1	.....do	In crank shaft	S.	
	1	.....do	Brake lever to shaft	S.	
	1	Lever spring	Secure to screw support	S.	
	1	Lever center	In clutch lever	Bz.	
	1	Nut	On rear elevating screw	Bz.	
	1	Nuts, standard	On clutch lever handle	S.	
	2	.....do	On castor yoke	S.	
	2	.....do	On castor pins	S.	
	2	.....do	On front axle	S.	
	2	Oil plugs, 0.375	In front wheels	Bz.	
	1	.....do	In crank shaft bracket	Bz.	
	2	.....do	In caster wheels	Bz.	
	2	.....do	In caster yoke	Bz.	
	1	.....do	In center shaft	Bz.	
	4	Packings	In follower	Hydraulic.	
	4	Pins	In guide ring bushing	Bz.	
	4	.....do	In screw support bushing	Bz.	
	4	.....do	In castor bushing	Bz.	
	4	.....do	In caster wheel bushing	Bz.	
	4	.....do	In front wheel bushings	Bz.	
	1	.....do	In crank handle	S.	
	1	.....do	Riveted in buffer plunger	S.	
	1	Plunger	Assembled in buffer bracket	F. S.	
	1	Rear support	Part of truck frame	S. An.	
	18	Rivets	Bracket to truck	W. I.	
	8	.....do	Cartridge shelf rear ends to shelf.	W. I.	
	6	.....do	Cartridge shelf stiffener to shelf.	W. I.	
	4	.....do	Cartridge shelf front support to shelf.	W. I.	
	12	.....do	Cartridge shelf rear support to rear support.	W. I.	
	12	.....do	Front angle to cartridge shelf and front support.	W. I.	
	8	.....do	Top plate to frame	W. I.	
	10	.....do	In corner plates, front	W. I.	
	4	.....do	In corner plates, rear	W. I.	
	6	.....do	Hinge to frame	W. I.	
	2	.....do	Stop for handles to frame	W. I.	
	4	.....do	Wooden handles to truck handle	W. I.	
	2	.....do	Brake lever guide to frame	W. I.	
	4	.....do	Screw support to frame	W. I.	
	2	.....do	Tray support to tray	W. I.	
	12	.....do	Guide ring to top plate	W. I.	
	2	.....do	Elevating screw	W. I.	
	6	Screws, 0.125	In ball bearings	Bz.	
	2	Screws, 0.5	In brake shoes and shaft	S.	
	6	Screws, 0.125	In caster bearings	Bz.	
	2	Screws, 0.375	In lever spring	S.	
	1	Screw support	Riveted to truck frame	S.	
	1	Shot tray	Top member of truck	S. S.	
	2	Shot tray pins	In elevating screw ends	Bz.	
	2	Split pins	In shot tray pins	S.	
	2	Shot tray rests	Riveted to shot tray	C. S.	
	2	Split pins	In front axle	S.	
	2	.....do	In caster yokes	S.	
	2	.....do	In caster pin	S.	
	1	.....do	In clutch lever handle	S.	
	1	Spring	In buffer bracket	Sp. S.	
	1	Stop for handle	Riveted to rear frame	S. An.	
	1	Spur wheel nut	On elevating screw	Bz.	
	2	Tires	On front wheels	R	Vulcanized on.
	2	.....do	On caster wheels	R.	Do.
	1	Top plate	On top of truck	S. S.	Riveted to frame.
	1	Tray support	Riveted to shot tray	Bz.	
	1	Truck handle	On hinge at rear of truck	S.	1 complete.
	2	Washers	On caster yokes	S.	
	2	.....do	On front axle	S.	
	2	.....do	Crank handle	Br.	

SHOT TONGS. (7 PAIRS FOR EACH CARRIAGE.)

	1	Claw, inner	Opposite outer claw	F. S.	In 2 parts.
	1	Claw, outer	Pivoted on centerpiece	F. S.	Do.
	1	Dog	.....do	F. S.	
	1	Pin, center	Forms pivot for claws and dog.	S.	
	1	Pin, shackle	In upper end of outer claw	S.	

Electrical equipment—10-inch D. C., model of 1894 M1—Continued.

SHOT TONGS. (7 PAIRS FOR EACH CARRIAGE)—Continued.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	2	Separators	Between 2 parts of outer claw	S.	Riveted to claw.
	3	.....do	Between 2 parts of inner claw	S.	Do.
	1	Shackle	Pivoted on shackle pin	F. S.	Engages inner claw.
	2	Split pins	For ends of shackle pins	S.	
	2	.....do	For ends of center pin	S.	
	1	Spreader	For outer claw	S.	
	1	.....do	For inner claw	S.	

LANYARD ATTACHMENT.

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Case	Secured to filler piece on elevating band.	Bz.	Filler piece indexed under carriage proper.
	1	Case cover	On case A14E1	Bz.	
	2	Case bolts	Securing case to filler piece	S.	With nuts.
	1	Firing leaf cord	On lanyard extension		Log line, minimum diameter, 16; maximum diameter, 18.
	1	Hook	On firing leaf cord		Bessemer steel annealed wire to straighten at 140 pounds pull.
	1	Lanyard cord	Part of lanyard extension		Log line, minimum diameter, 16; maximum diameter, 18.
	1	Lanyard guide	Attached to gun near breach	Bz.	
	2	Lanyard guide screws.	Lanyard guide to gun	S.	
	1	Nut	On spring shaft	S.	
	1	Pawl	On case A14E1, acuated by cam.	S.	Cam indexed under carriage proper.
	1	Pawl pin	Through pawl A14H2	S.	
	1	Pawl spring	In pawl A14H2	Sp. S.	
	1	Pin	Riveted in reel	S.	
	1	.....do	Riveted in spring shaft	S.	
	1	Reel	In case A14E1	Bz.	
	1	Reel cord	Wound around reel A14F		Linen soft braid 0.175 diameter.
	1	Ring	On lanyard extension	F. S.	Galvanized.
	1	Spring	On reel in case	Sp. S.	
	1	Spring shaft	Holding spring in case	S.	
	1	Spring-shaft pin	Holding spring shaft in case	S.	
	2	Snap hooks	On firing leaf and lanyard cords.	S.	Comm.
	1	Thimble	On reel cord A14R1	Comm.	Galvanized.

GREASE CUPS. (6 PER CARRIAGE.)

Piece mark.	No.	Name of part.	Location.	Material.	Remarks.
	1	Body	Screwed into carriage	Bz.	
	1	Cap	On upper end of body A2A	Bz.	
	1	Cup, leather	Underneath plunger		Made of leather.
	1	Plunger	Inside of grease cup	Bz.	
	1	Plunger nut	Secures the plunger to cap A2B.	Bz.	
	1	Screw	Secures cup leather A2D1 to plunger A2E1.	Bz.	
	1	Split pin	For plunger nut A2G	S.	
	1	Spring	Between cap A2B and plunger A2E1.	S.	Of 5 colis, 552 pounds resistance when solid.
	1	Washer	Under cup leather A2D1	Bz.	

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